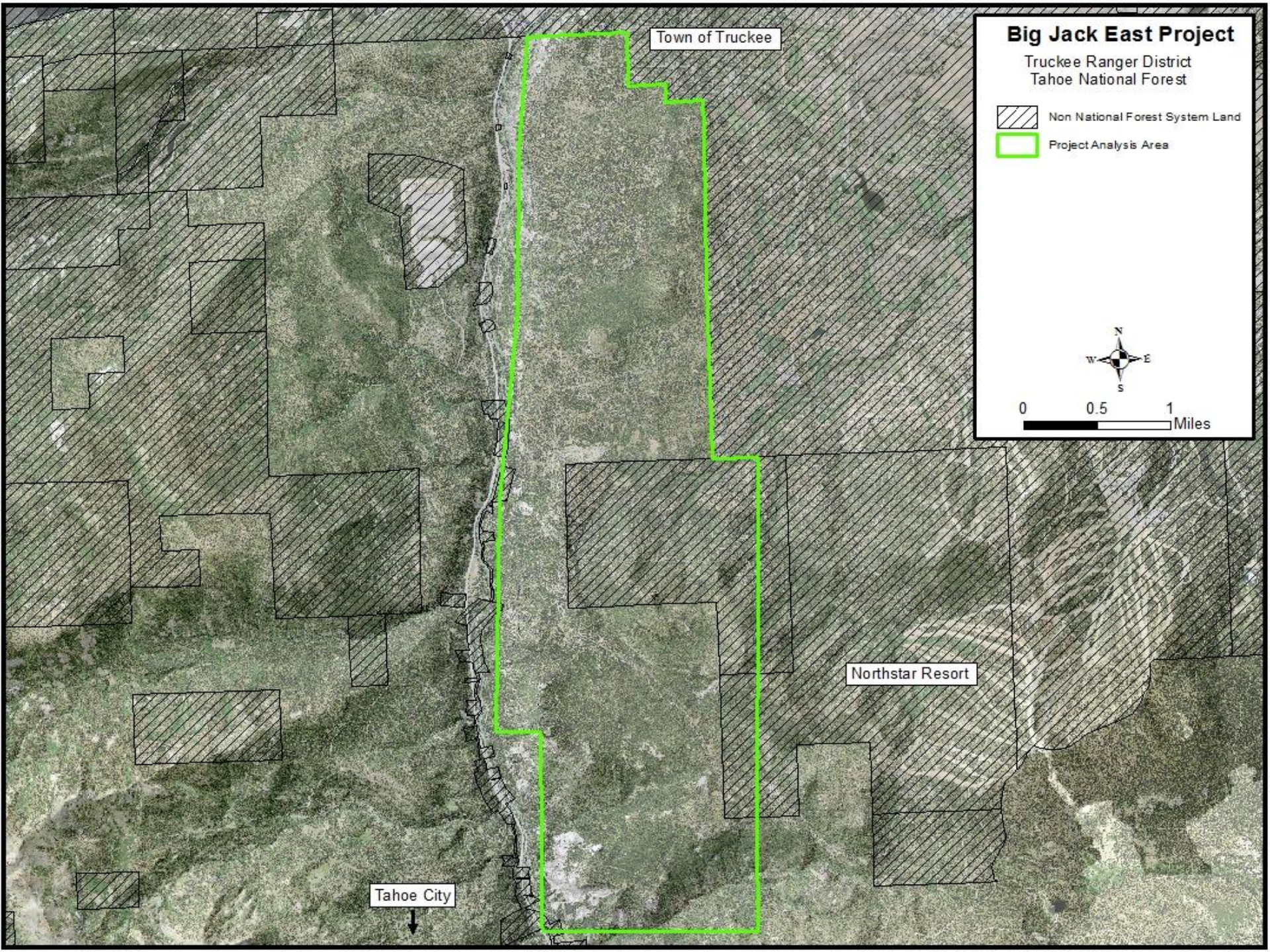
Landscape LiDAR and Managing Forests at Multiple Scales

a Tahoe National Forest case study

- Current assessments
  - Visualizations
  - Applying coarse datasets to project planning
- Tahoe National Forest LiDAR
  - Visualizations
  - "EcObject" vegetation mapping
  - LiDAR informed landscape assessment
  - LiDAR aided project layout, surveys, and treatment effects modeling
- Conclusions
- Next Steps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Truckee Ranger District
Tahoe National Forest
Non National Forest System Land
Project Analysis Area
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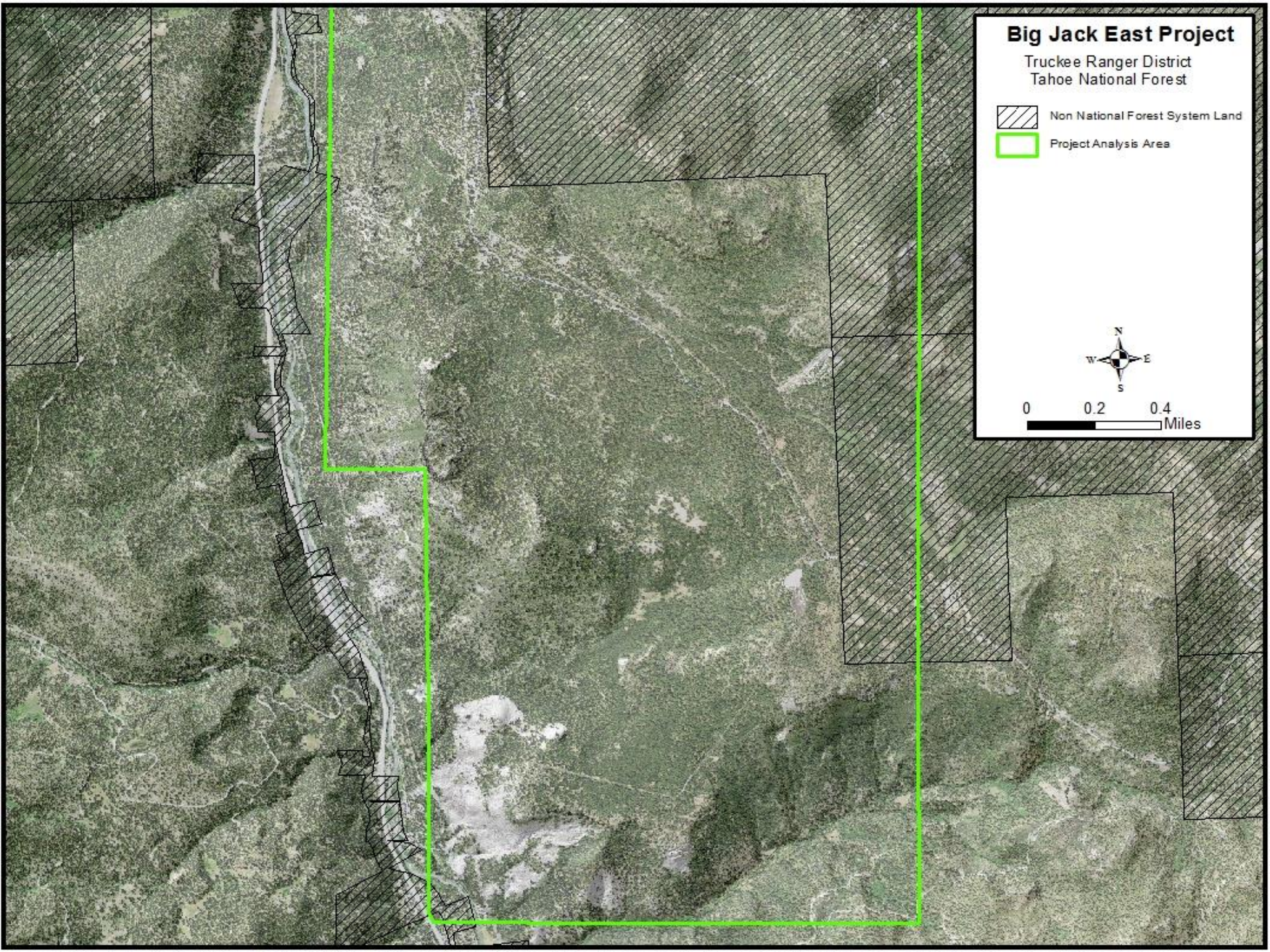
Miles
Town of Truckee
Northstar Resort
Tahoe City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Tahoe National Forest
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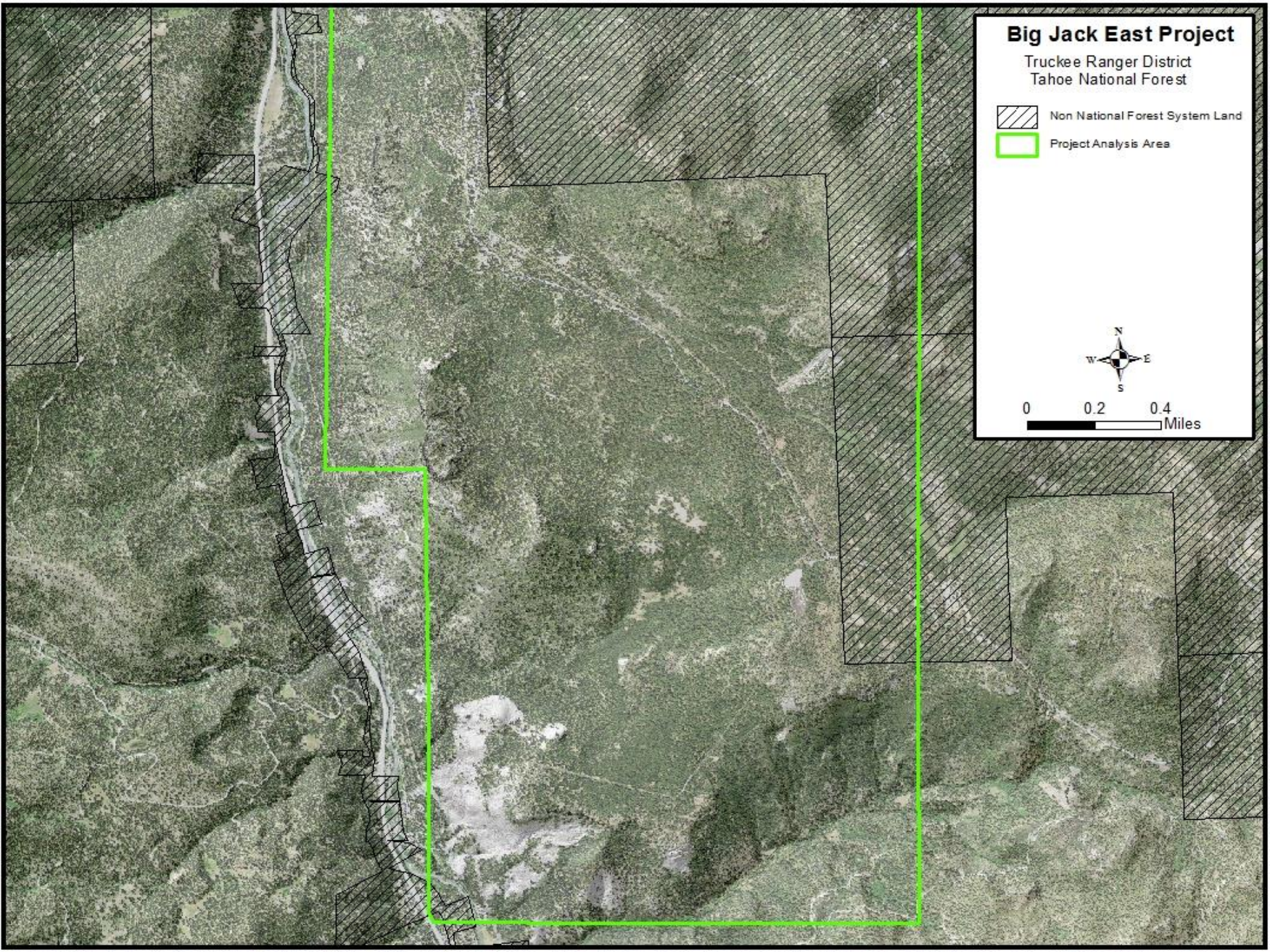
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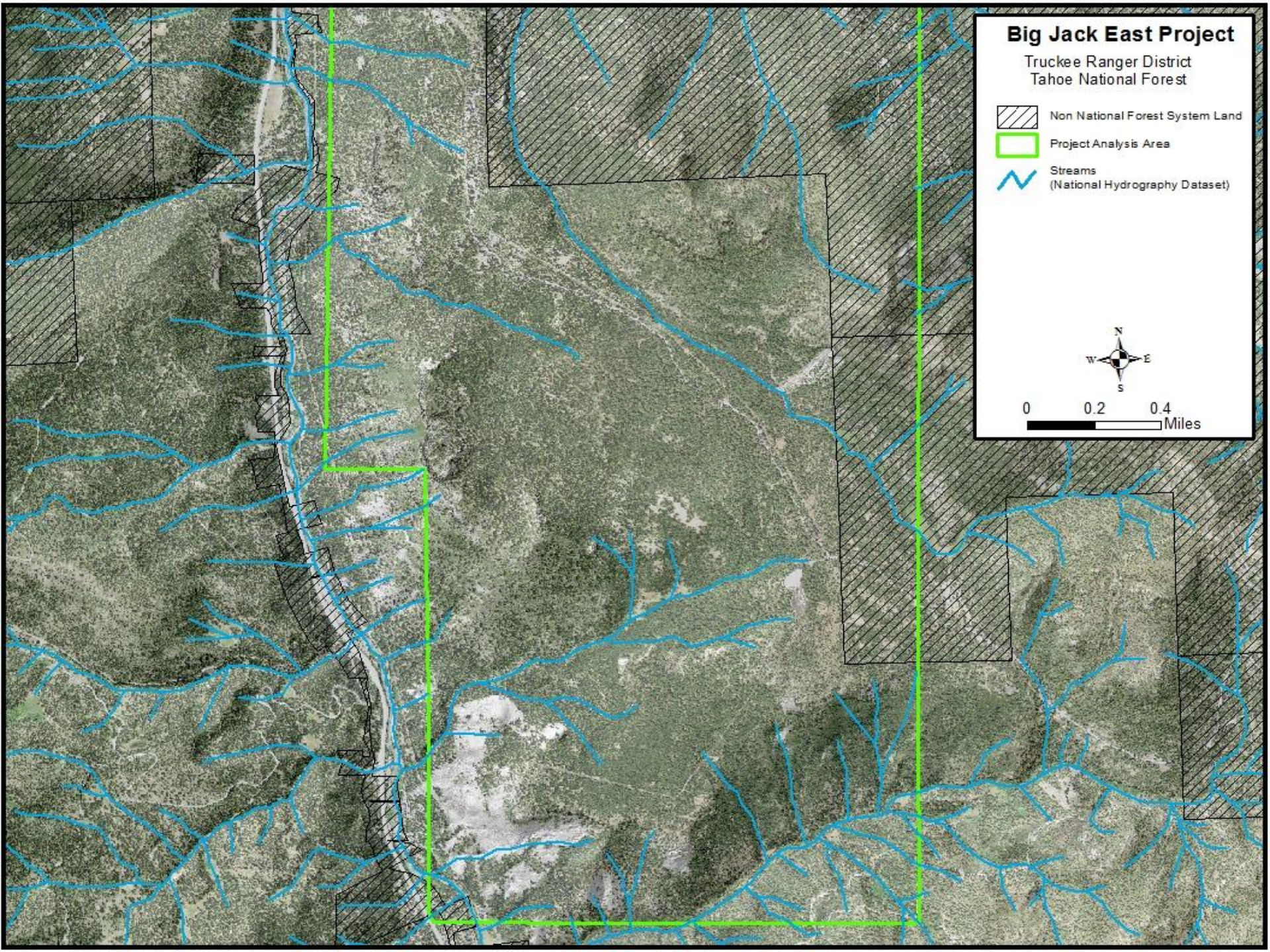
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Project Analysis Area
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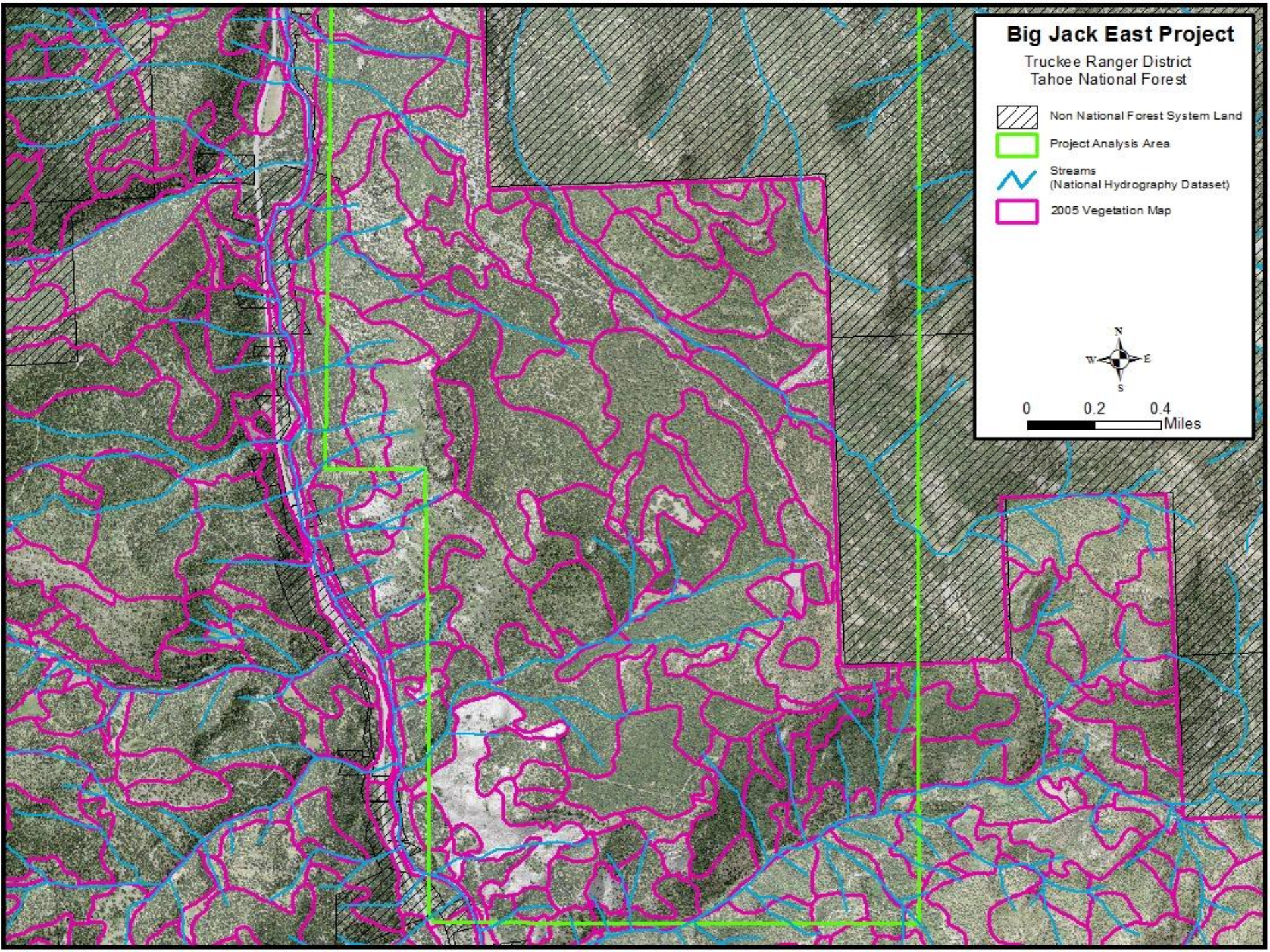
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Streams
(National Hydrography Dataset)
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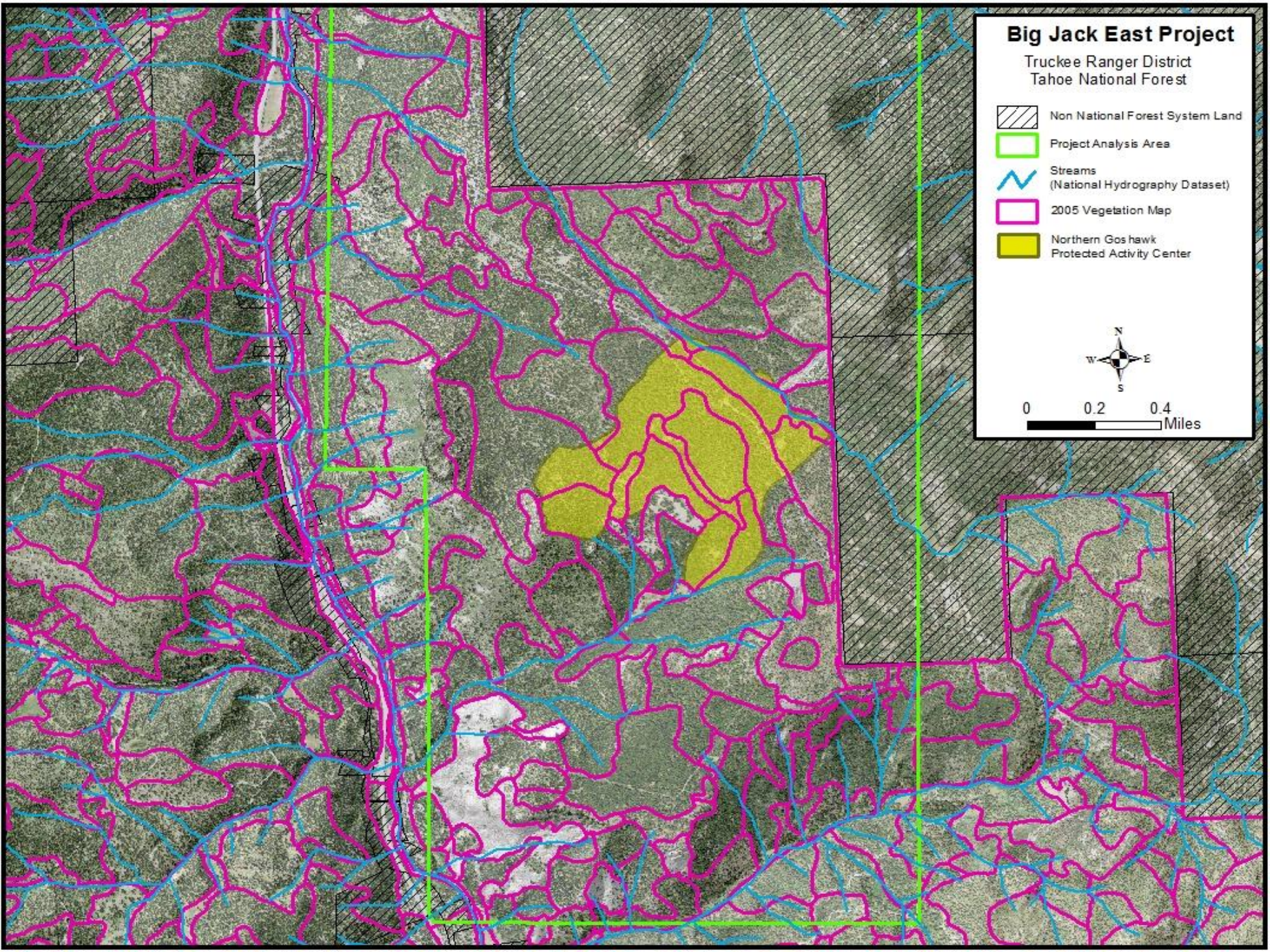
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2005 Vegetation Map
Northern Goshawk
Protected Activity Center
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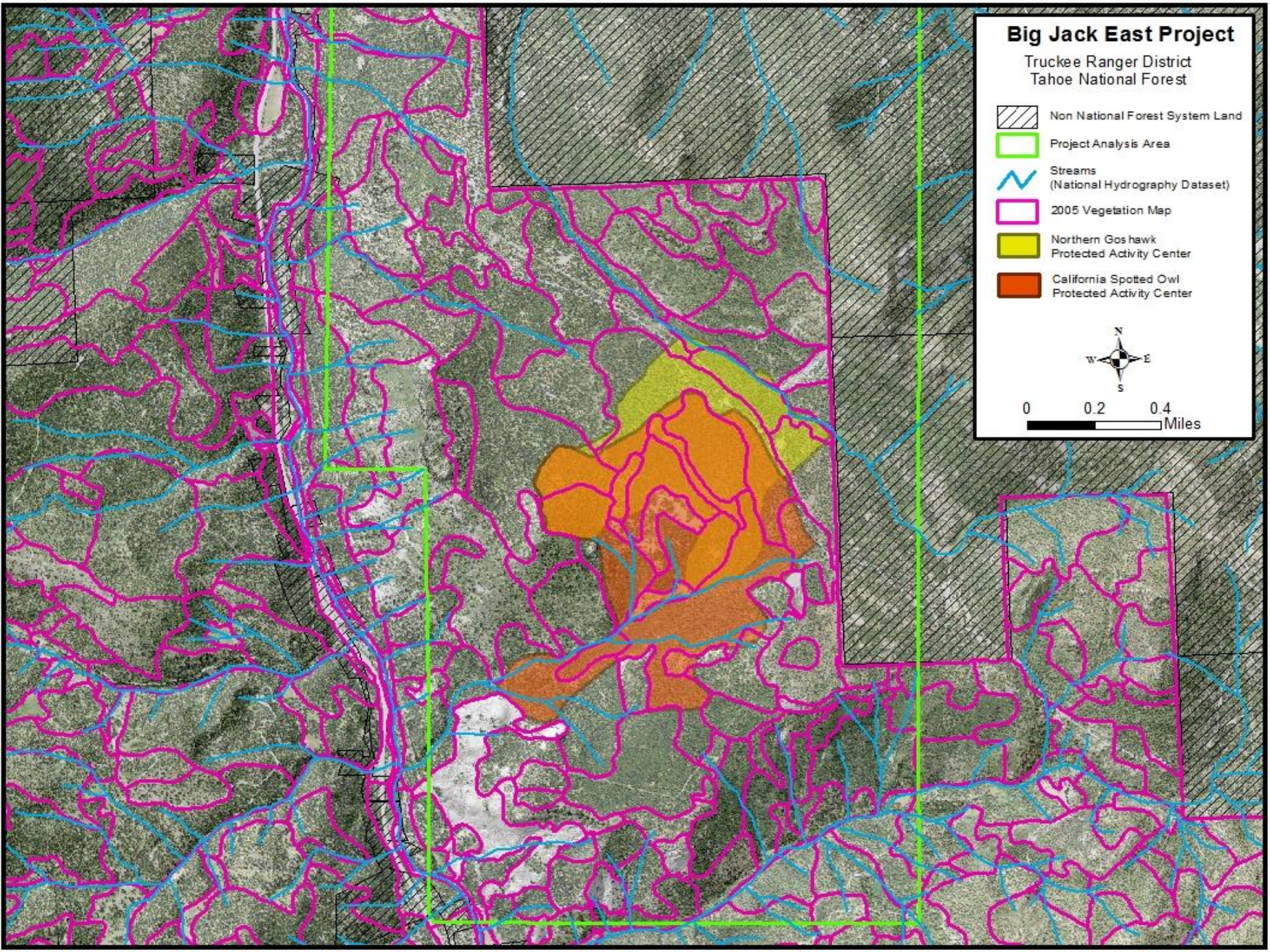
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Protected Activity Center
California Spotted Owl
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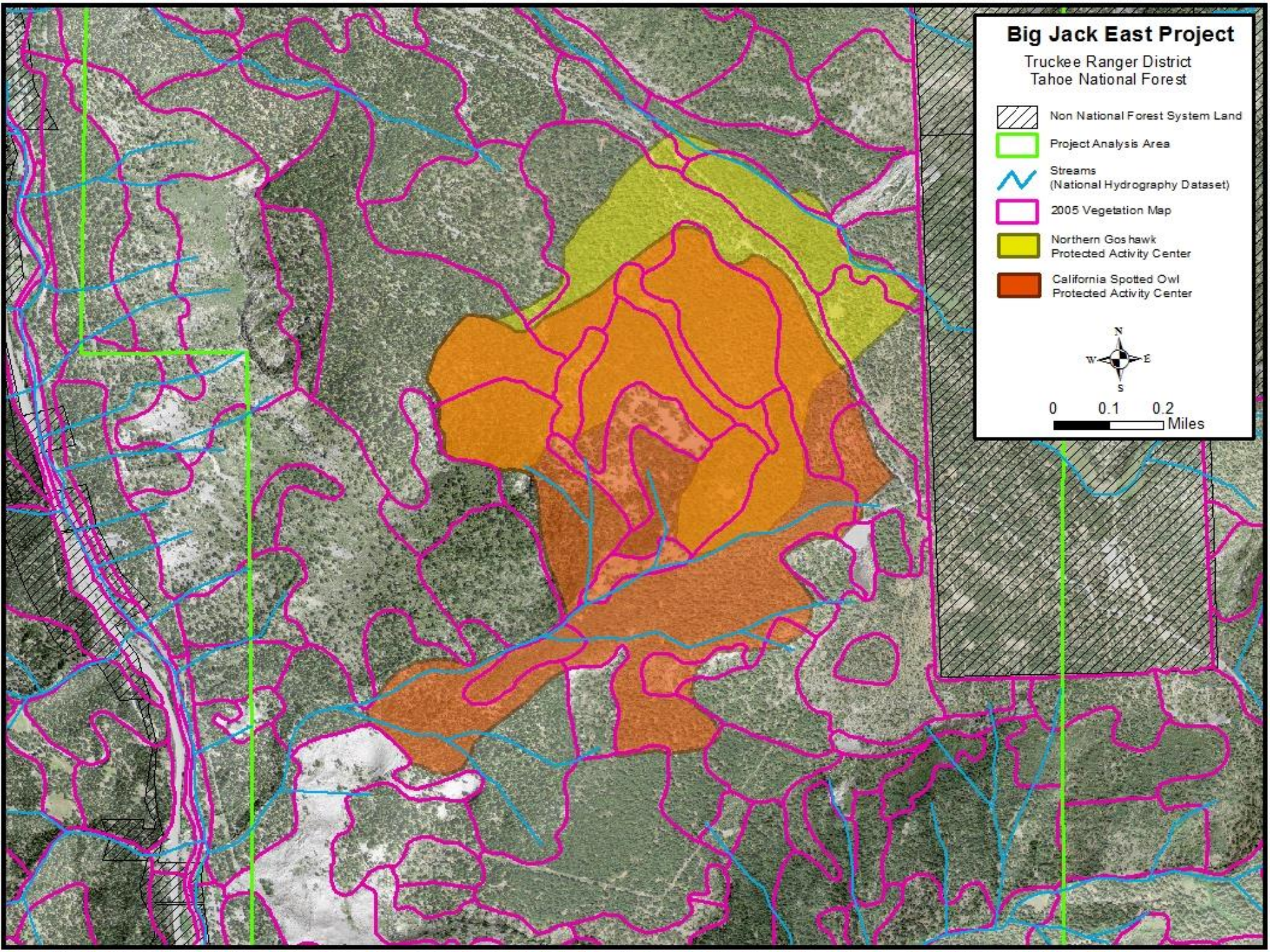
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Protected Activity Center
California Spotted Owl
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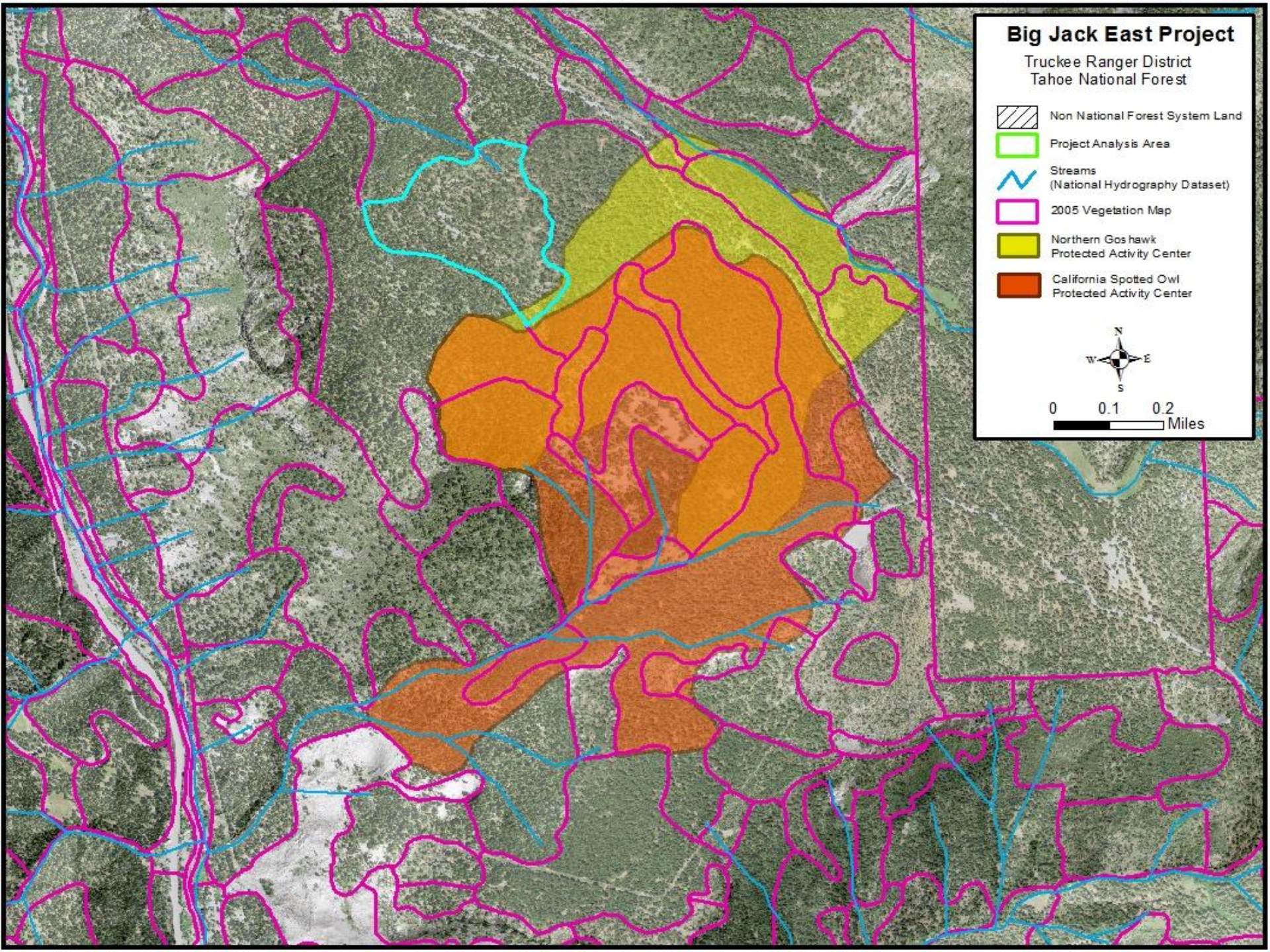
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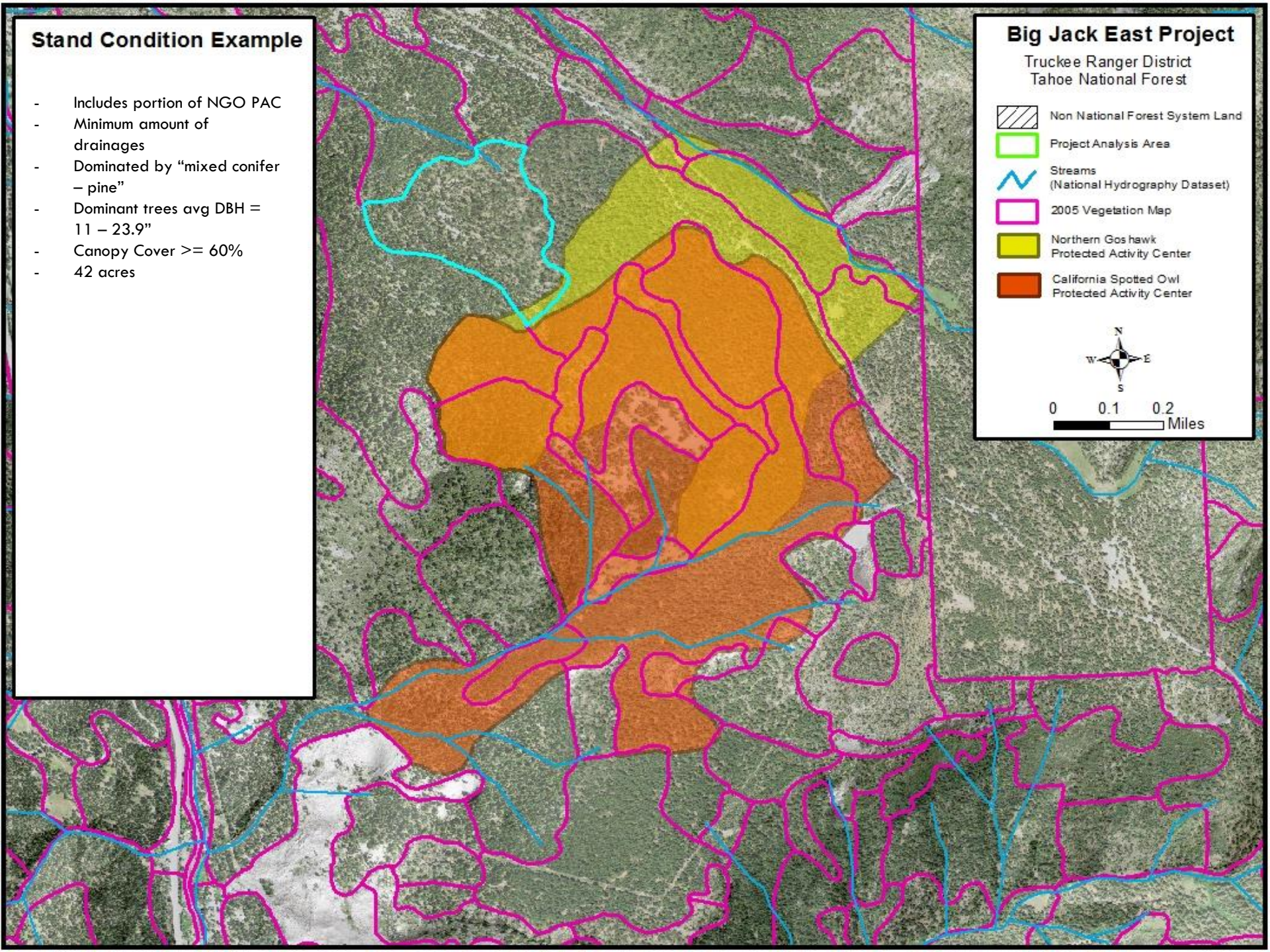
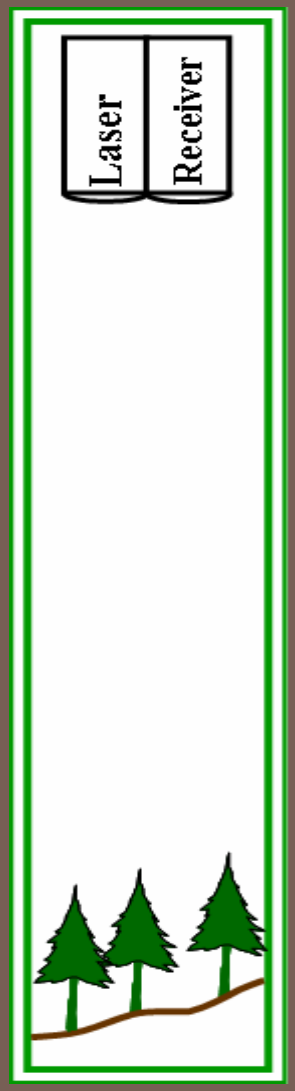
Miles

Stand Condition Example

- Includes portion of NGO PAC
- Minimum amount of drainages
- Dominated by "mixed conifer – pine"
- Dominant trees avg DBH = 11 – 23.9"
- Canopy Cover >= 60%
- 42 acres



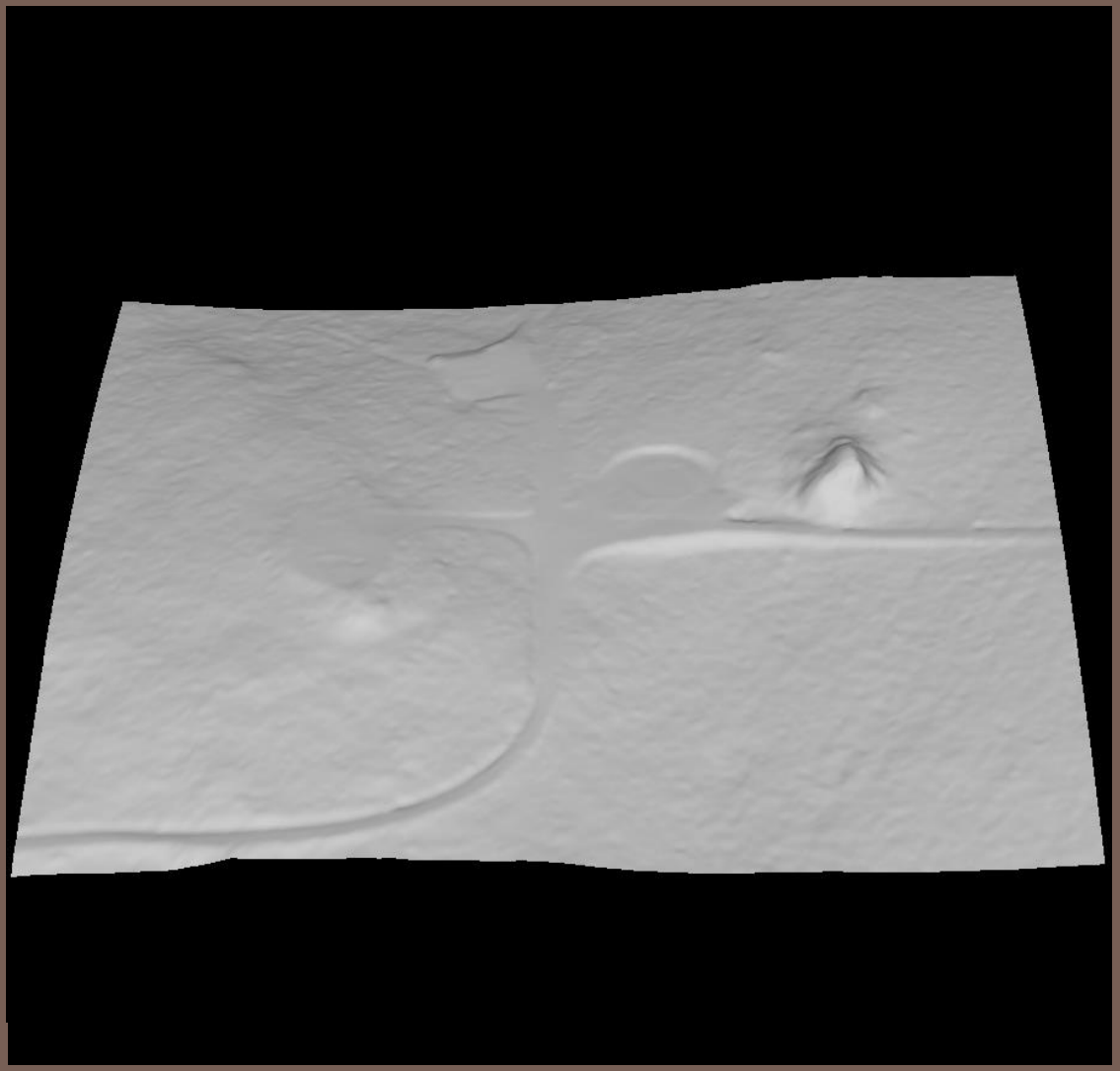


LIDAR -- Light Detection and Ranging

- Measures distances (through laser pulses) that strike and reflect from features on the surface of the earth.
- Converts scanning angle and distance-from-sensor information into georeferenced data points
- Collects 100-500 thousand positions/second ('point clouds')

Lidar data =

- Precisely referenced points in time and space
- Creates a “point cloud” can extract:
  - structures
  - vegetation
  - ground
  - rivers, roads, archeologic, etc.



Tahoe National Forest LiDAR

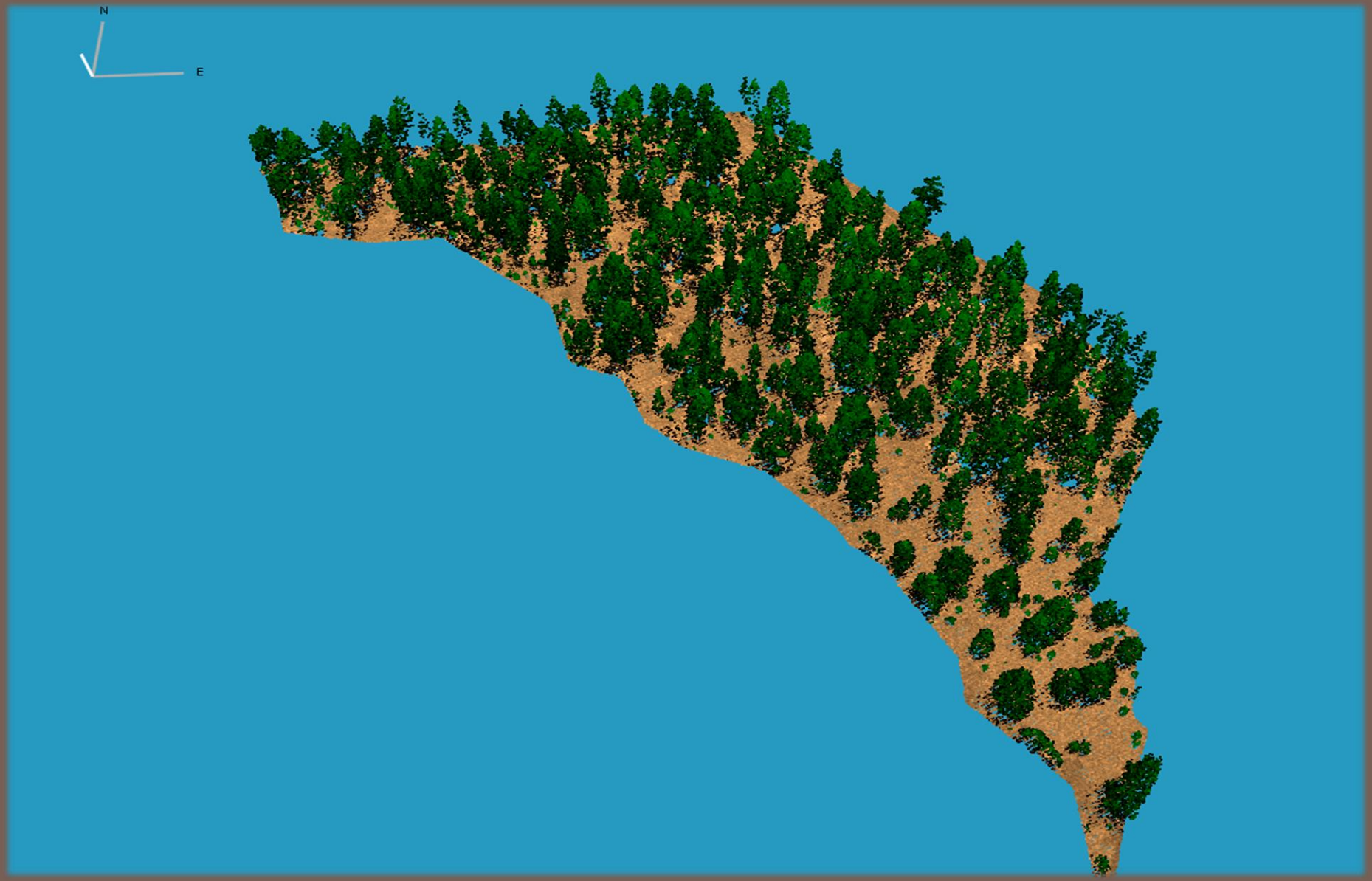
- 1.3 million acres flown in 2013/2014
- ~ $ 1 million
  - cost share between USFS & USGS
- 10-12 pulses per square meter
- 14 terabytes of data

USDA Forest Service
R5 Remote Sensing Lab

EcObject Vegetation Mapping

- Individual trees extracted from LiDAR (Objects)

Credits:
Bob McGaughey – USFS Pacific Northwest Research Station
University of Washington
Kirk Evans – USFS Remote Sensing Lab
Carlos Ramirez – USFS Remote Sensing Lab
Tanya Kohler – USFS Remote Sensing Lab
Rodney Hart – USFS Remote Sensing Lab
Christine Chu – USFS Remote Sensing Lab



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- Individual trees extracted from LiDAR (Objects)
- Aggregated by stand and tree-level "ecological" relationships into polygons (EcObjets)

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USDA Forest Service
R5 Remote Sensing Lab

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EcObject Vegetation Mapping

- Individual trees extracted from LiDAR (Objects)
- Aggregated by stand and tree-level "ecological" relationships into polygons (EcObjects)

- EcObjects are populated with a collection of forest metrics compiled from a suite of multidimensional datasets

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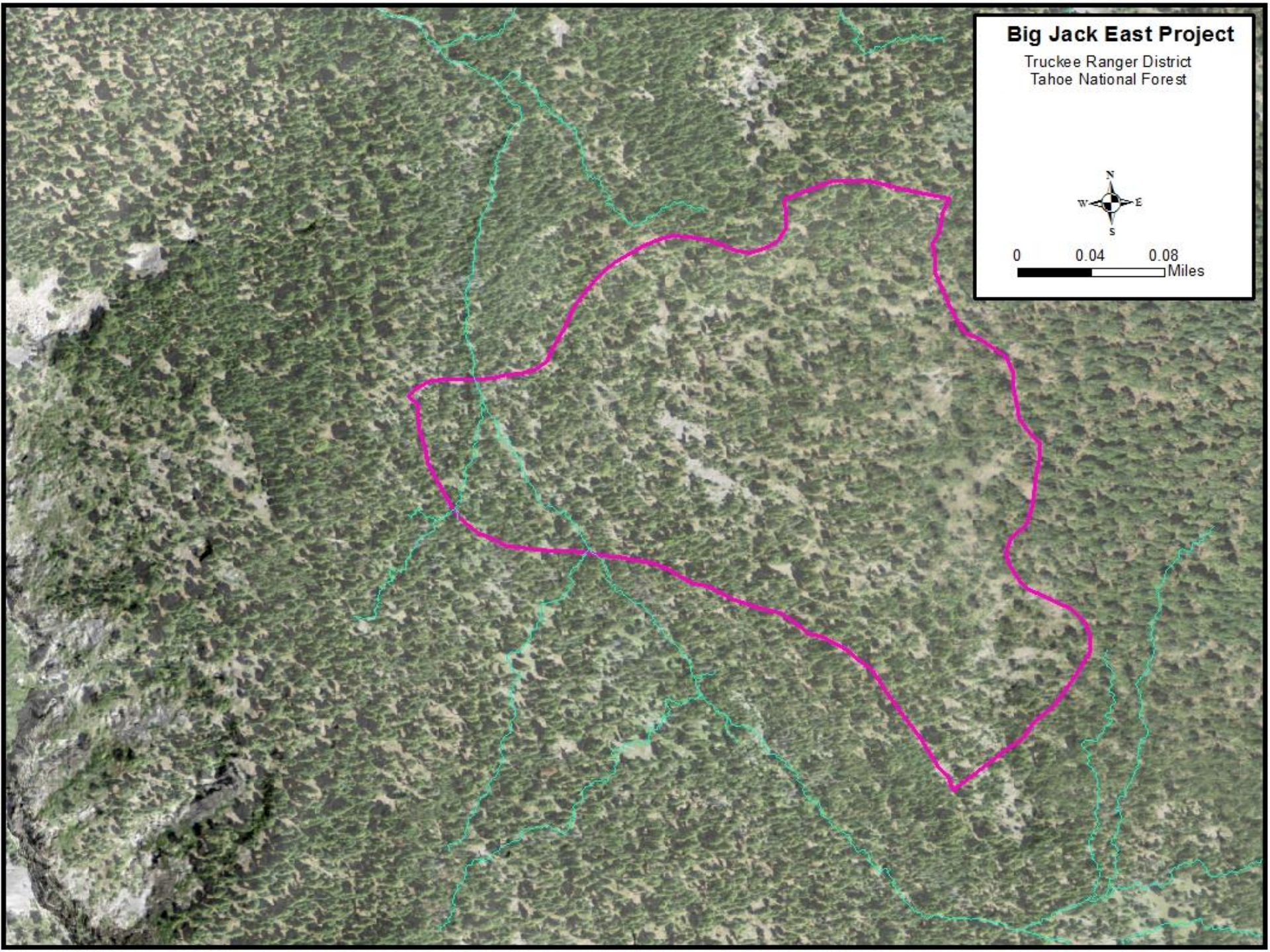
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Truckee Ranger District
Tahoe National Forest
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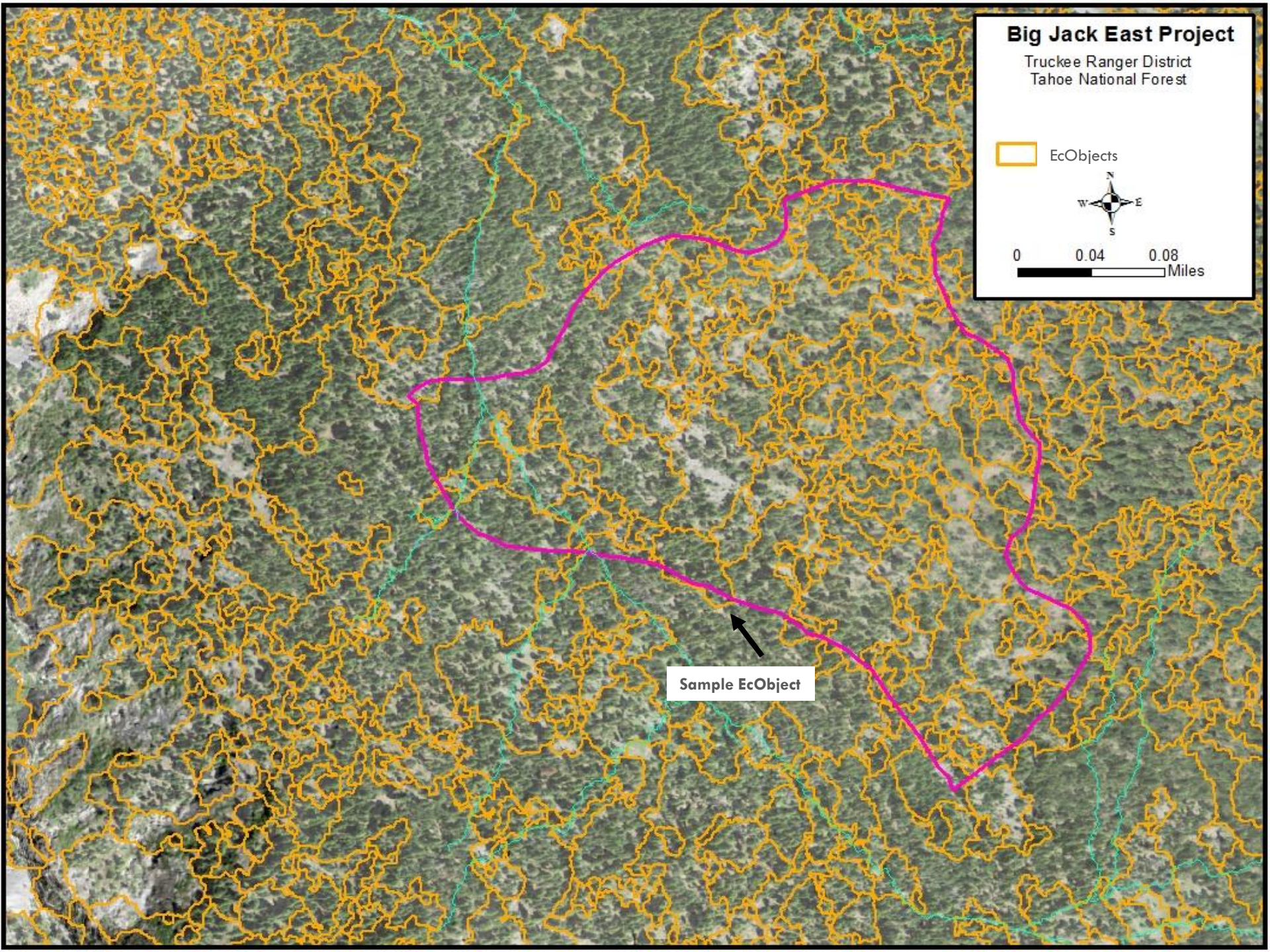
Big Jack East Project
Truckee Ranger District
Tahoe National Forest
EcObjects
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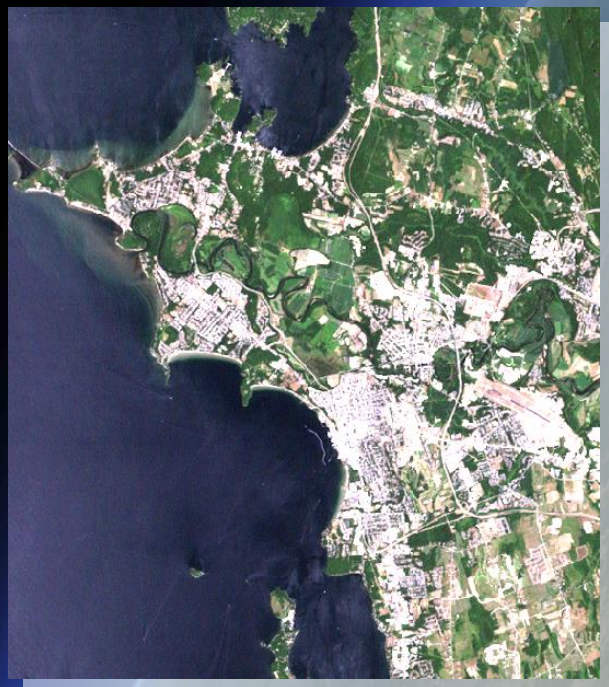
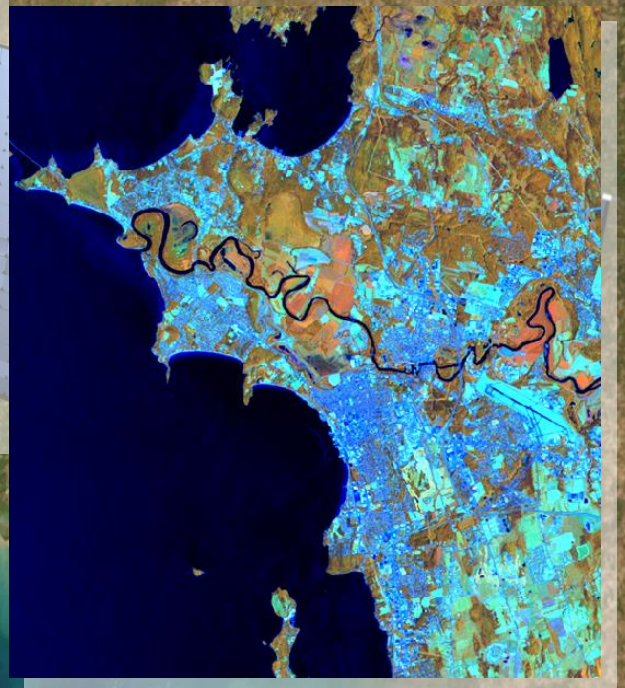
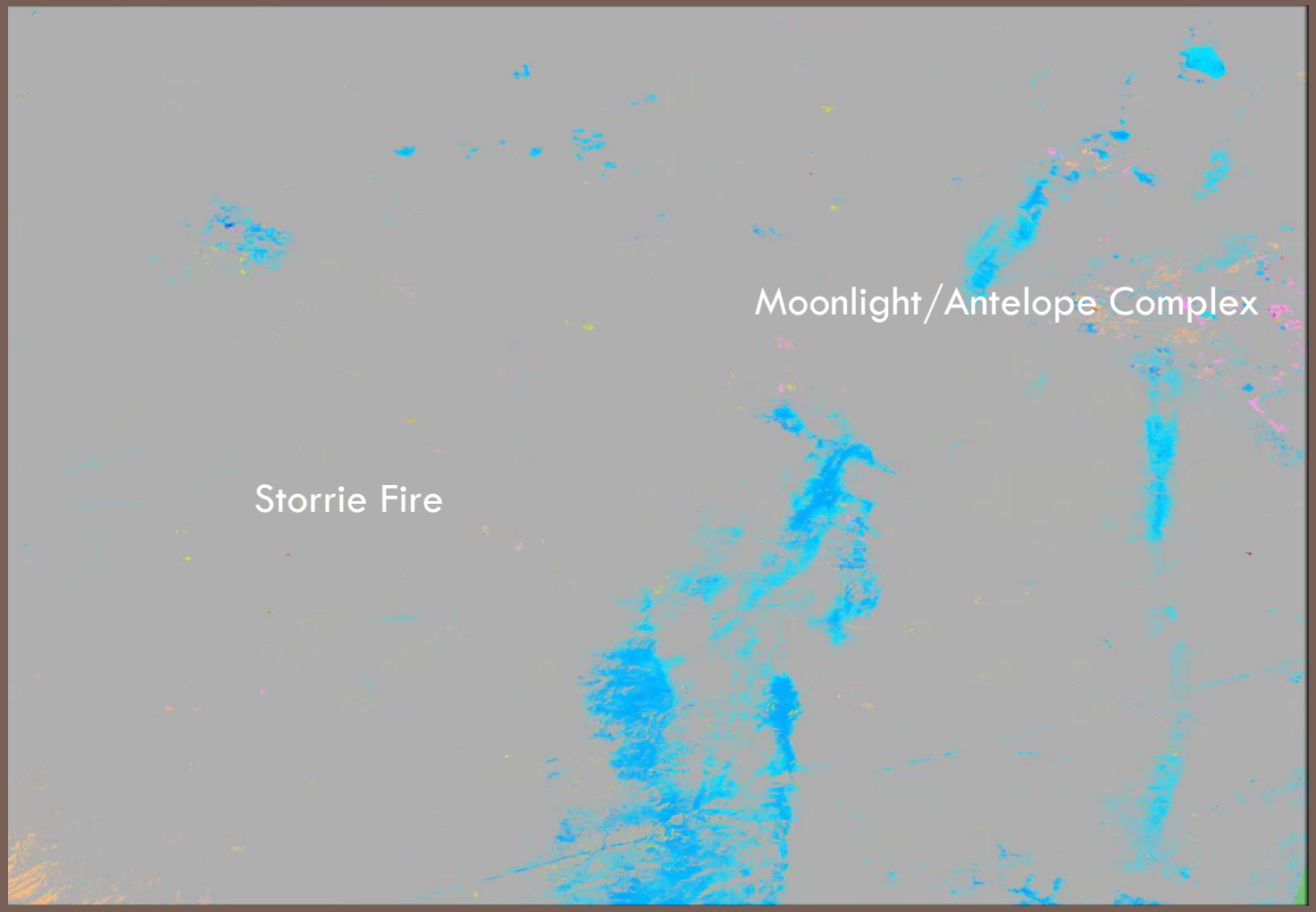
Miles
Sample EcObject

Landsat





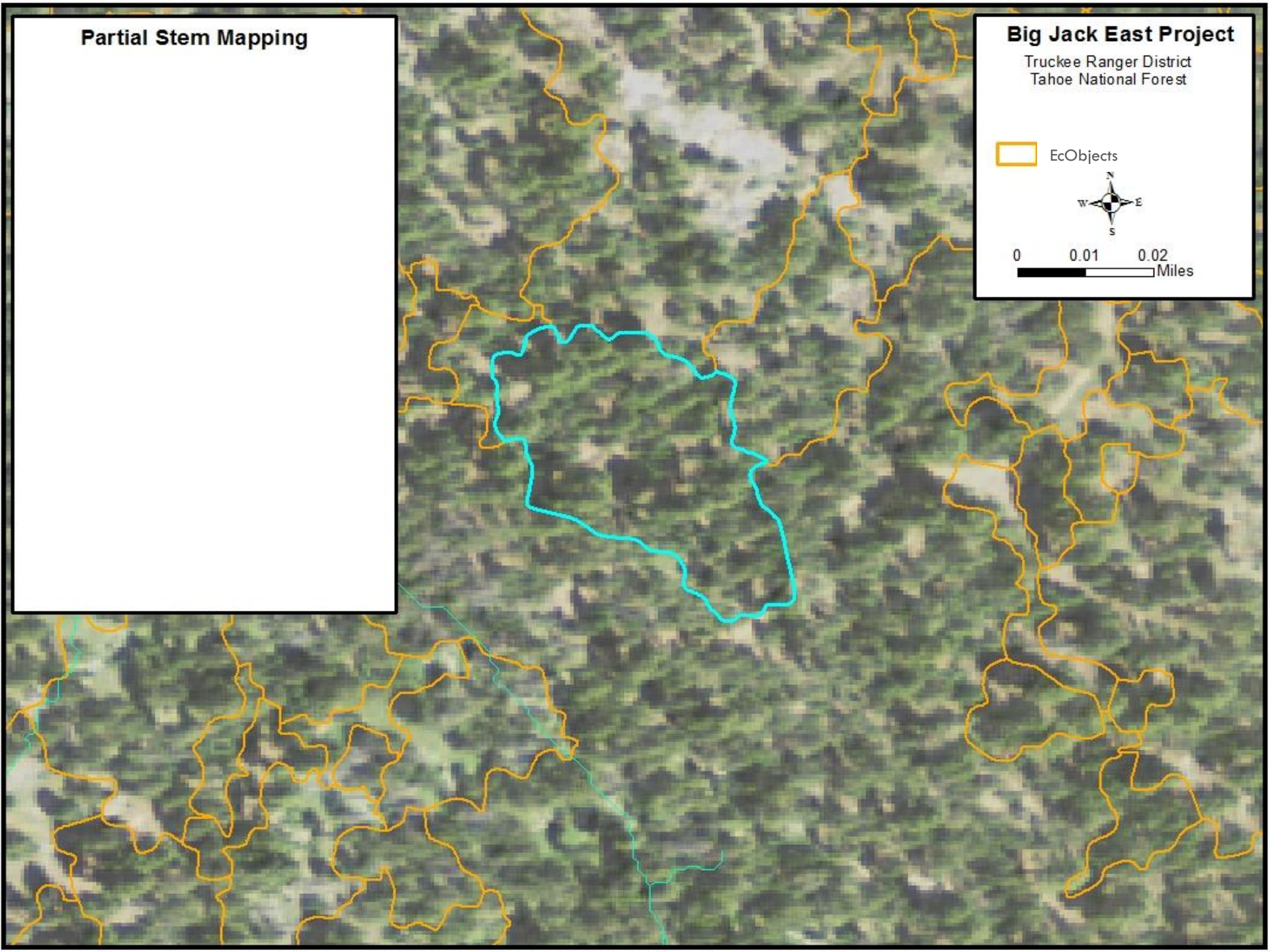
Ecosystem Disturbance and Recovery Tracker (eDaRT)
Plumas/Lassen National Forest 1998 - 2010



Classification

- Cloud/Snow
- Not disturbed/ Recovered
- Low Intensity Disturbance
- High Intensity Disturbance

Credits:
Alex Koltunov– USFS Remote Sensing Lab
Carlos Ramirez – USFS Remote Sensing Lab


Partial Stem Mapping
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Truckee Ranger District
Tahoe National Forest
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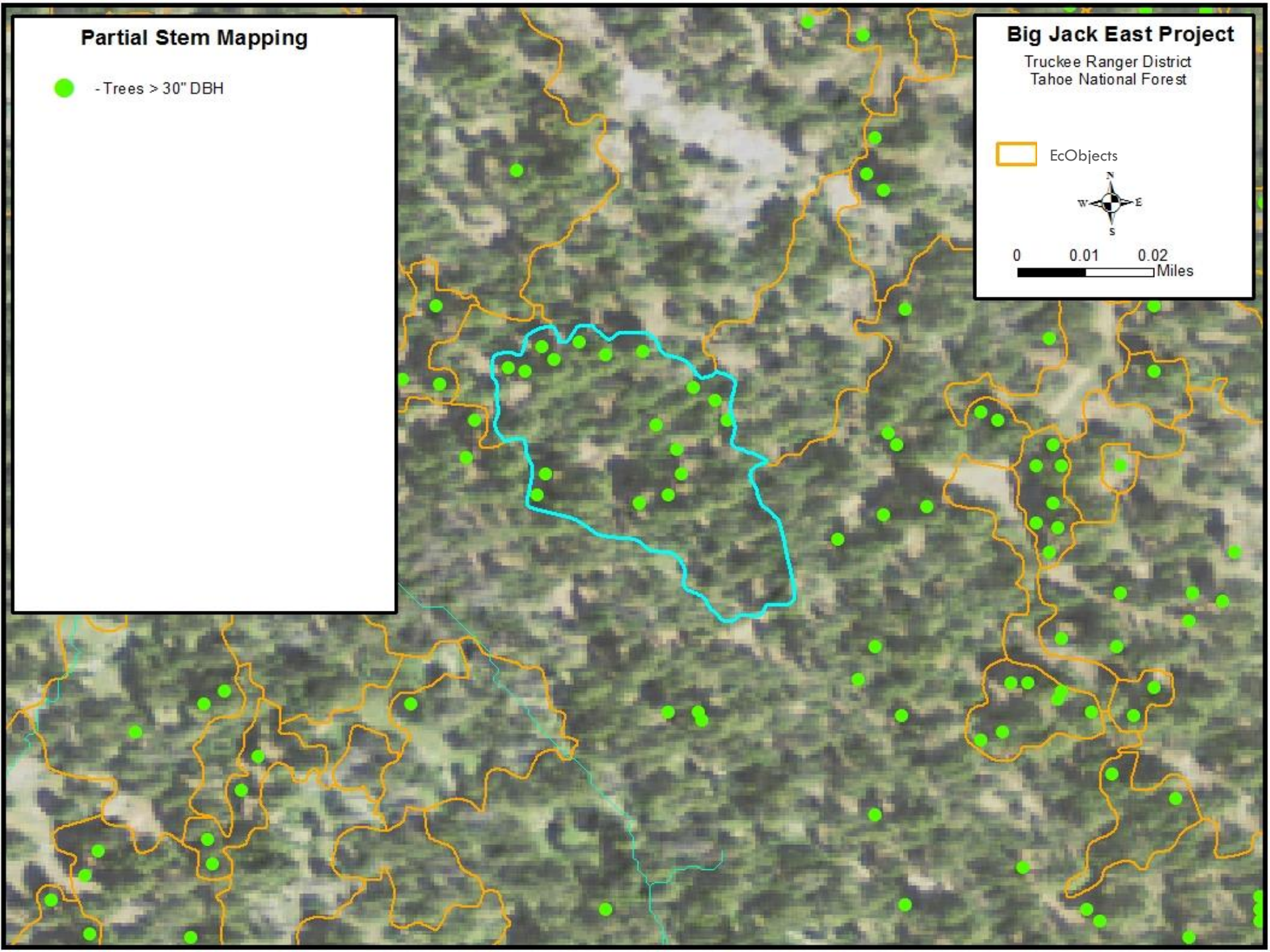
Miles


Partial Stem Mapping
- Trees > 30" DBH
Big Jack East Project
Truckee Ranger District
Tahoe National Forest
EcObjects
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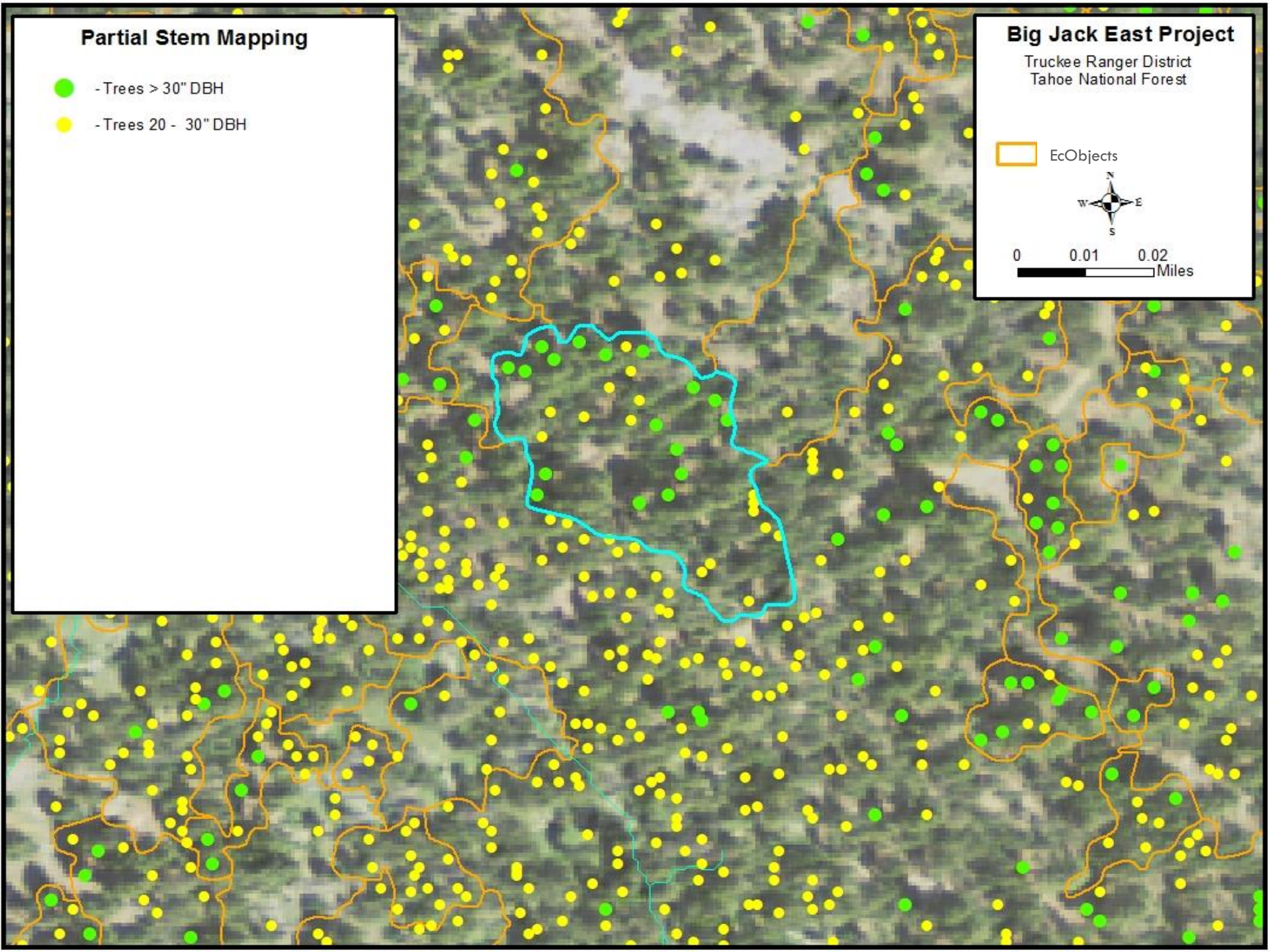
Partial Stem Mapping
- Trees > 30" DBH
- Trees 20 - 30" DBH
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Truckee Ranger District
Tahoe National Forest
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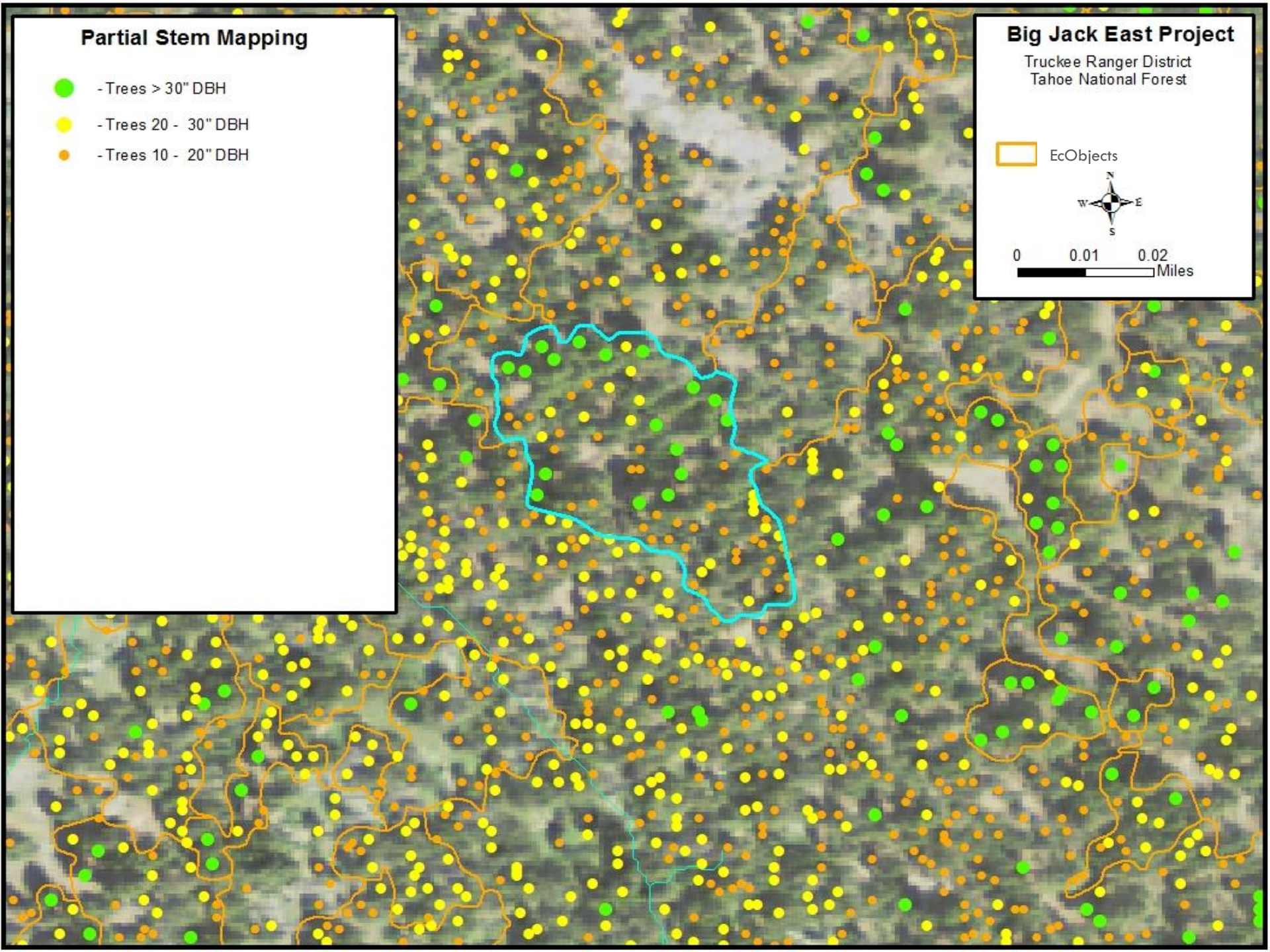
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- Trees 20 - 30" DBH
- Trees 10 - 20" DBH
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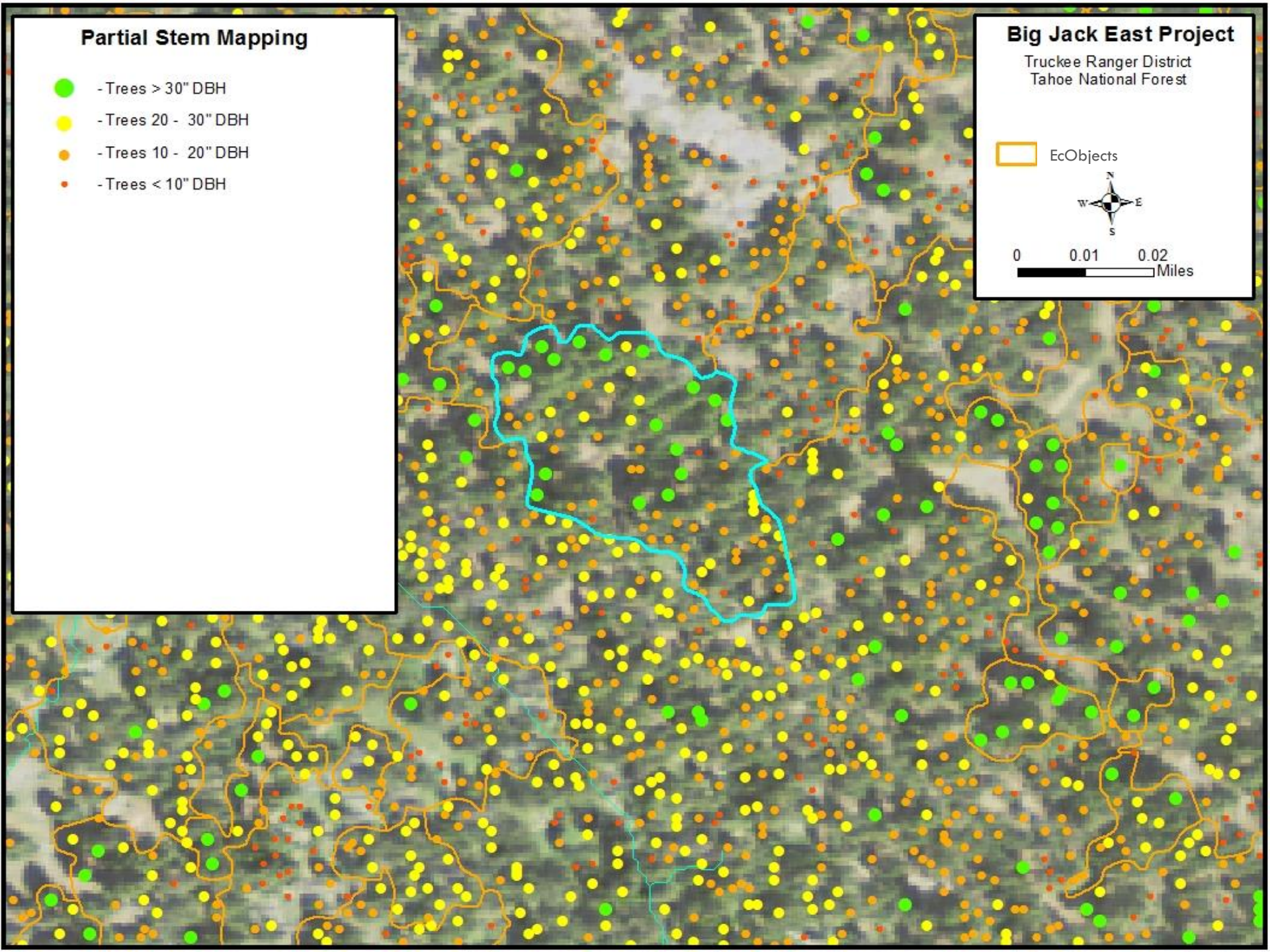
Partial Stem Mapping
- Trees > 30" DBH
- Trees 20 - 30" DBH
- Trees 10 - 20" DBH
- Trees < 10" DBH
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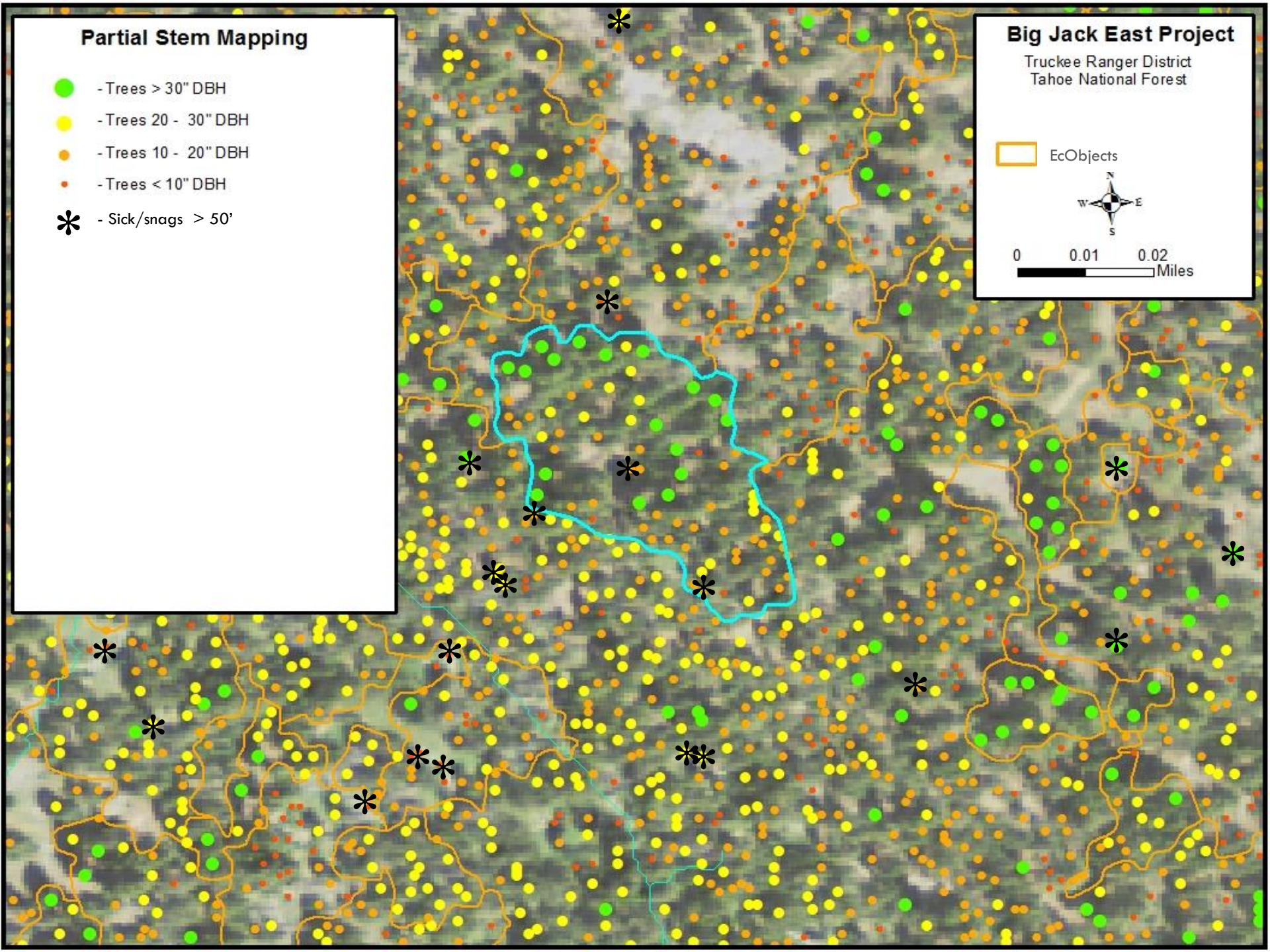
Partial Stem Mapping
- Trees > 30" DBH
- Trees 20 - 30" DBH
- Trees 10 - 20" DBH
- Trees < 10" DBH
- Sick/snags > 50'
Big Jack East Project
Truckee Ranger District
Tahoe National Forest
EcObjects
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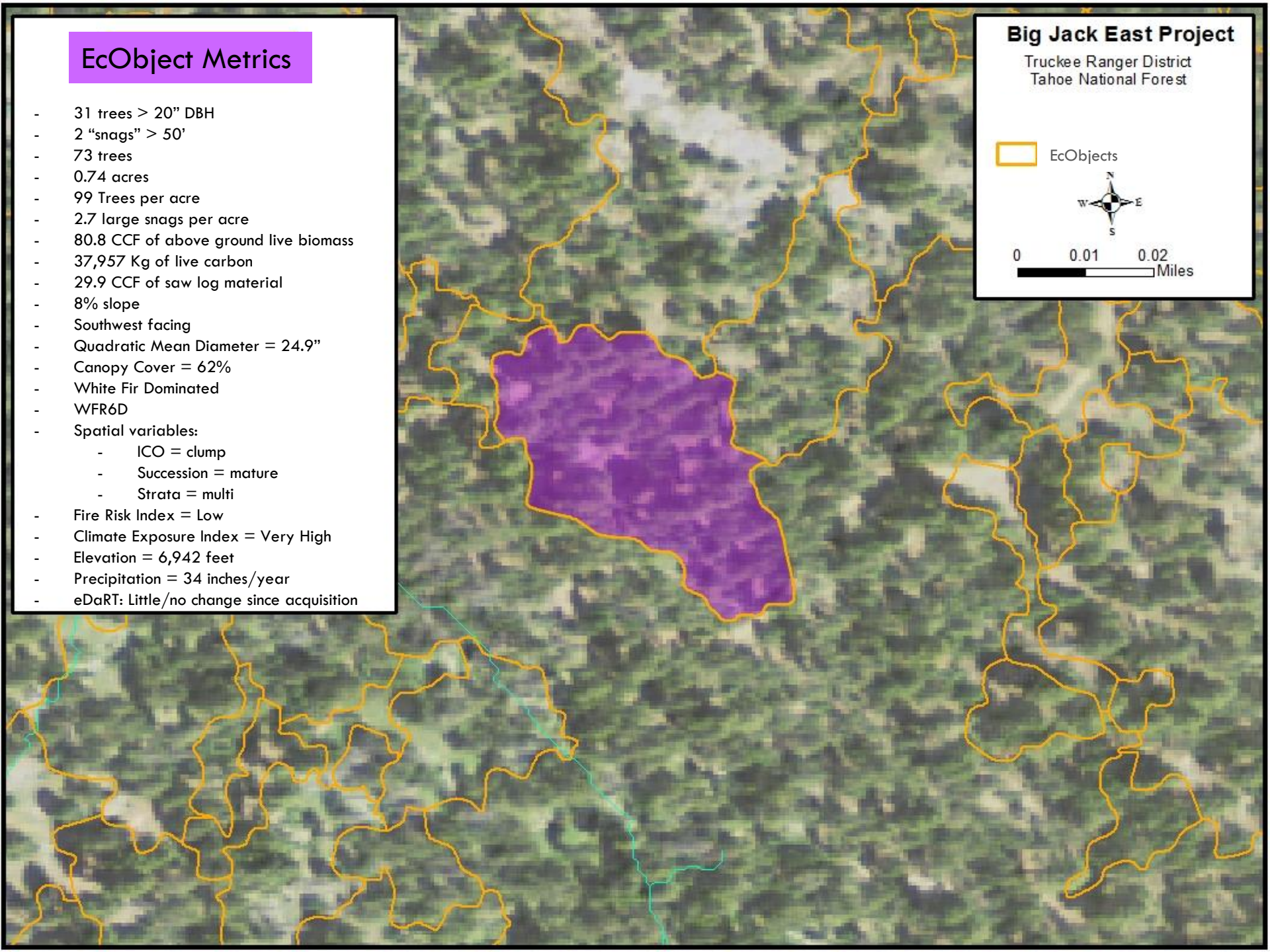
Miles

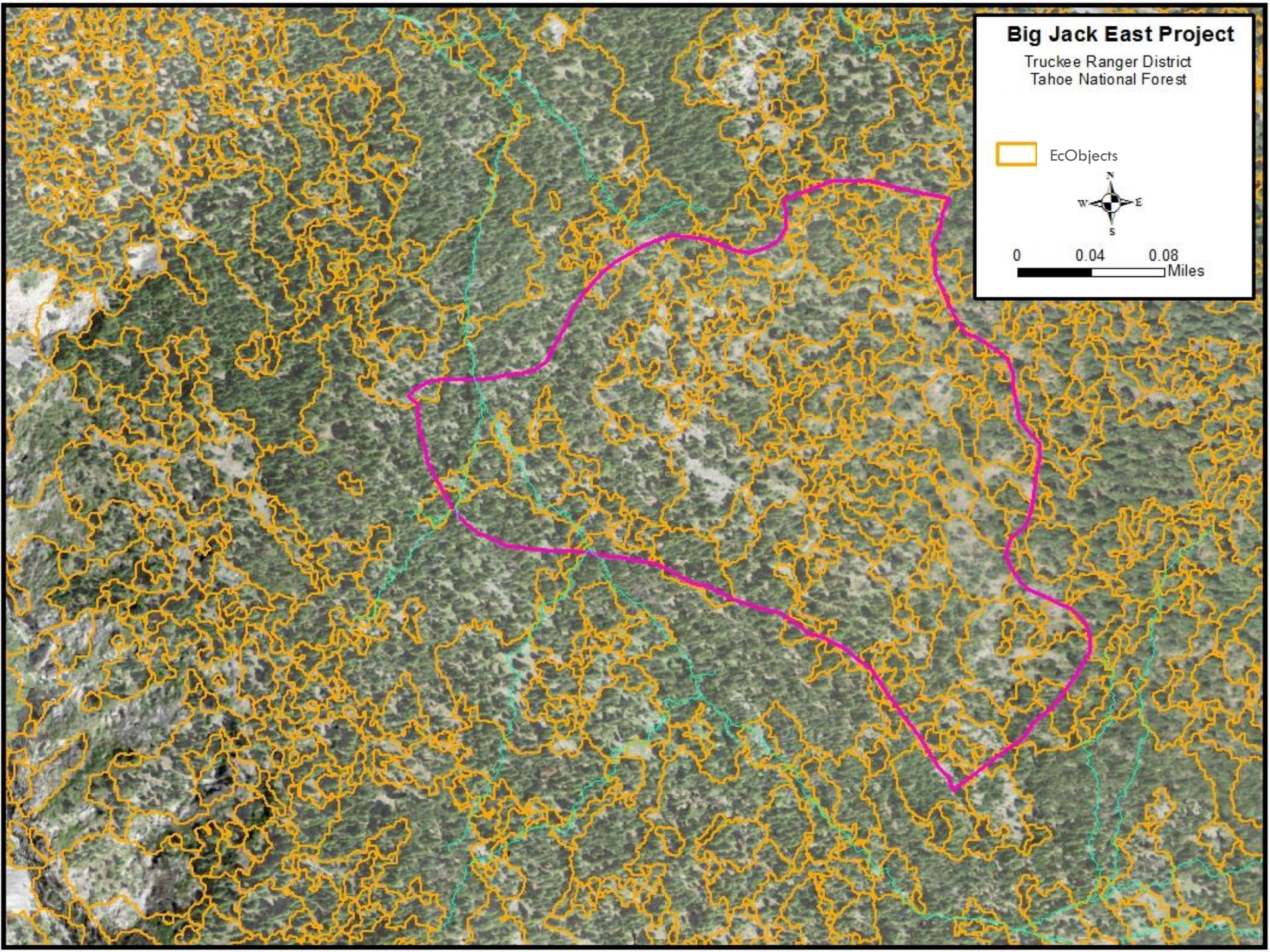
EcObject Metrics

- 31 trees > 20” DBH
- 2 “snags” > 50’
- 73 trees
- 0.74 acres
- 99 Trees per acre
- 2.7 large snags per acre
- 80.8 CCF of above ground live biomass
- 37,957 Kg of live carbon
- 29.9 CCF of saw log material
- 8% slope
- Southwest facing
- Quadratic Mean Diameter = 24.9”
- Canopy Cover = 62%
- White Fir Dominated
- WFR6D
- Spatial variables:
  - ICO = clump
  - Succession = mature
  - Strata = multi
- Fire Risk Index = Low
- Climate Exposure Index = Very High
- Elevation = 6,942 feet
- Precipitation = 34 inches/year
- eDaRT: Little/no change since acquisition



LANDSCAPE ASSESSMENT

- Seamless transition between scales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Tahoe National Forest
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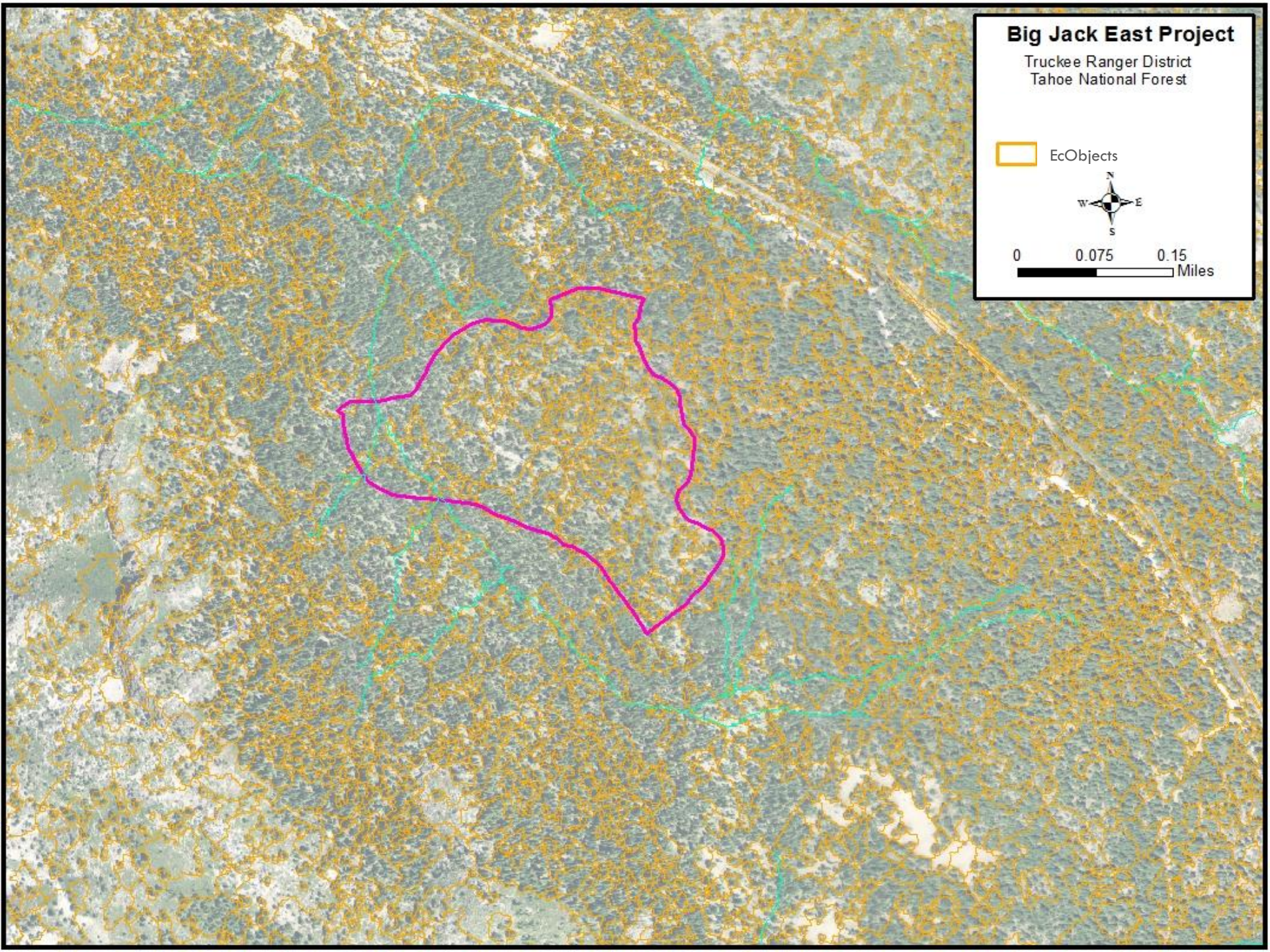
Miles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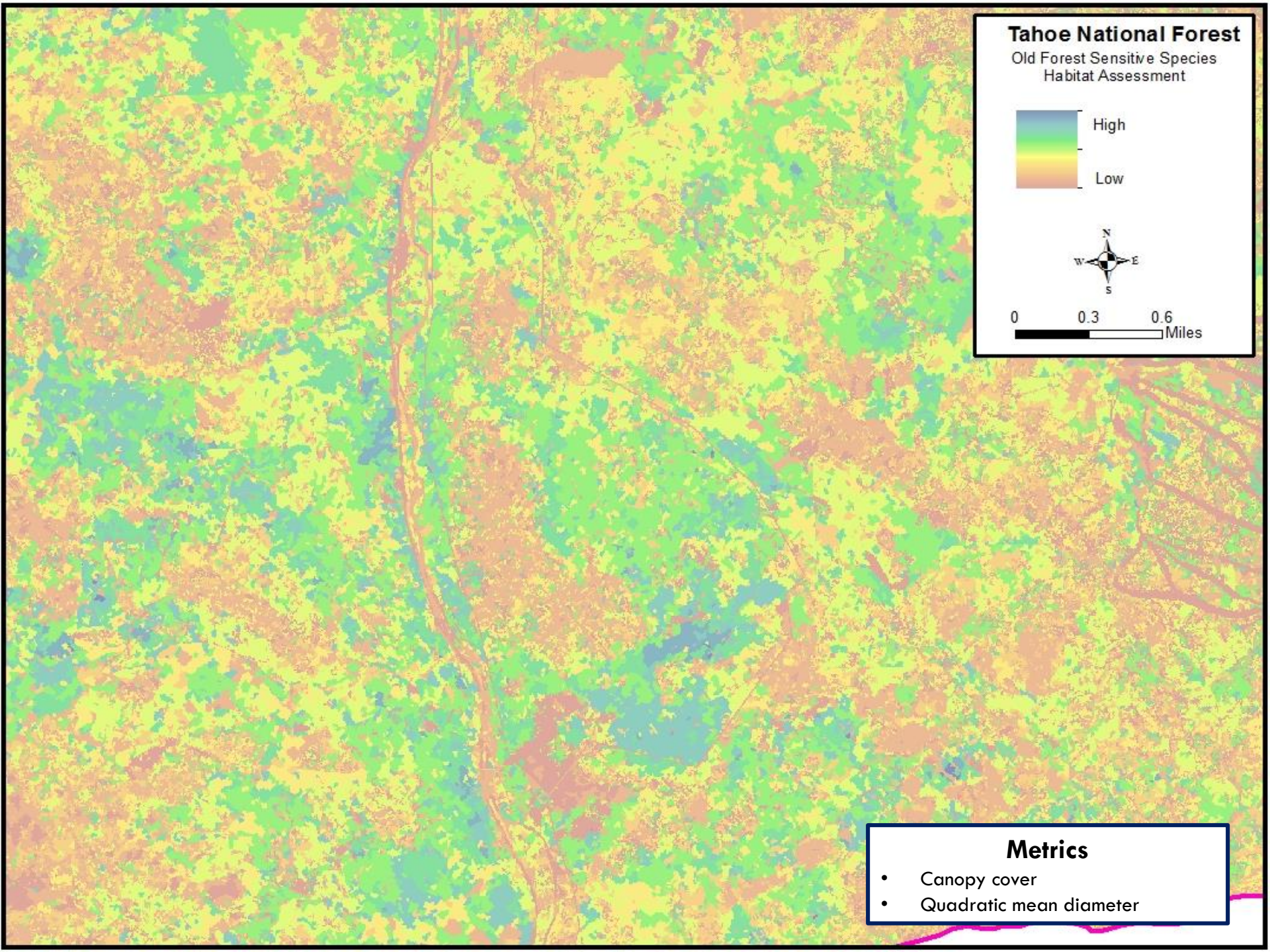
Tahoe National Forest
Old Forest Sensitive Species
Habitat Assessment
High
Low
N
W
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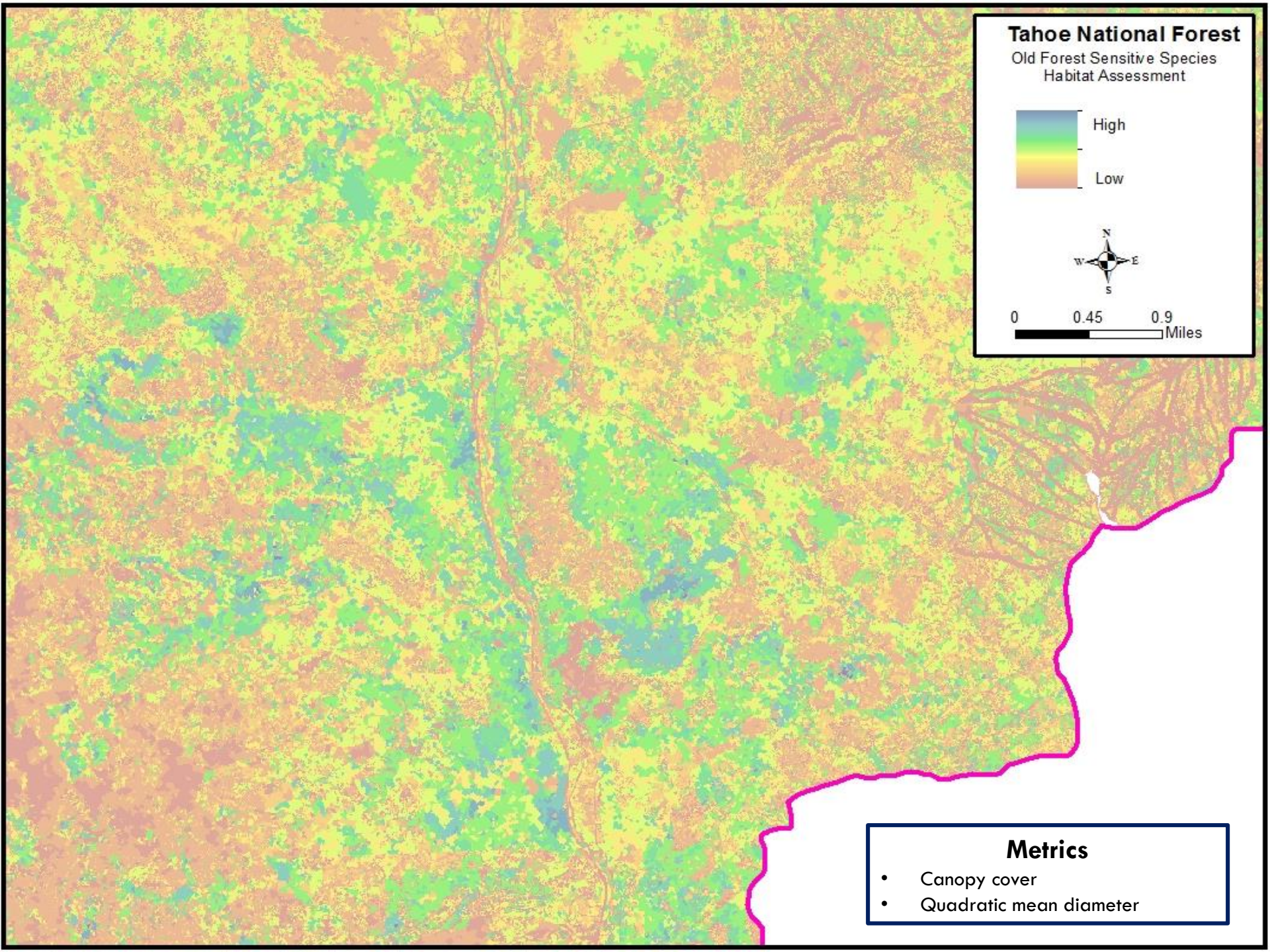
0
0.3
0.6
Miles
Metrics
• Canopy cover
• Quadratic mean diameter


Tahoe National Forest
Old Forest Sensitive Species
Habitat Assessment
High
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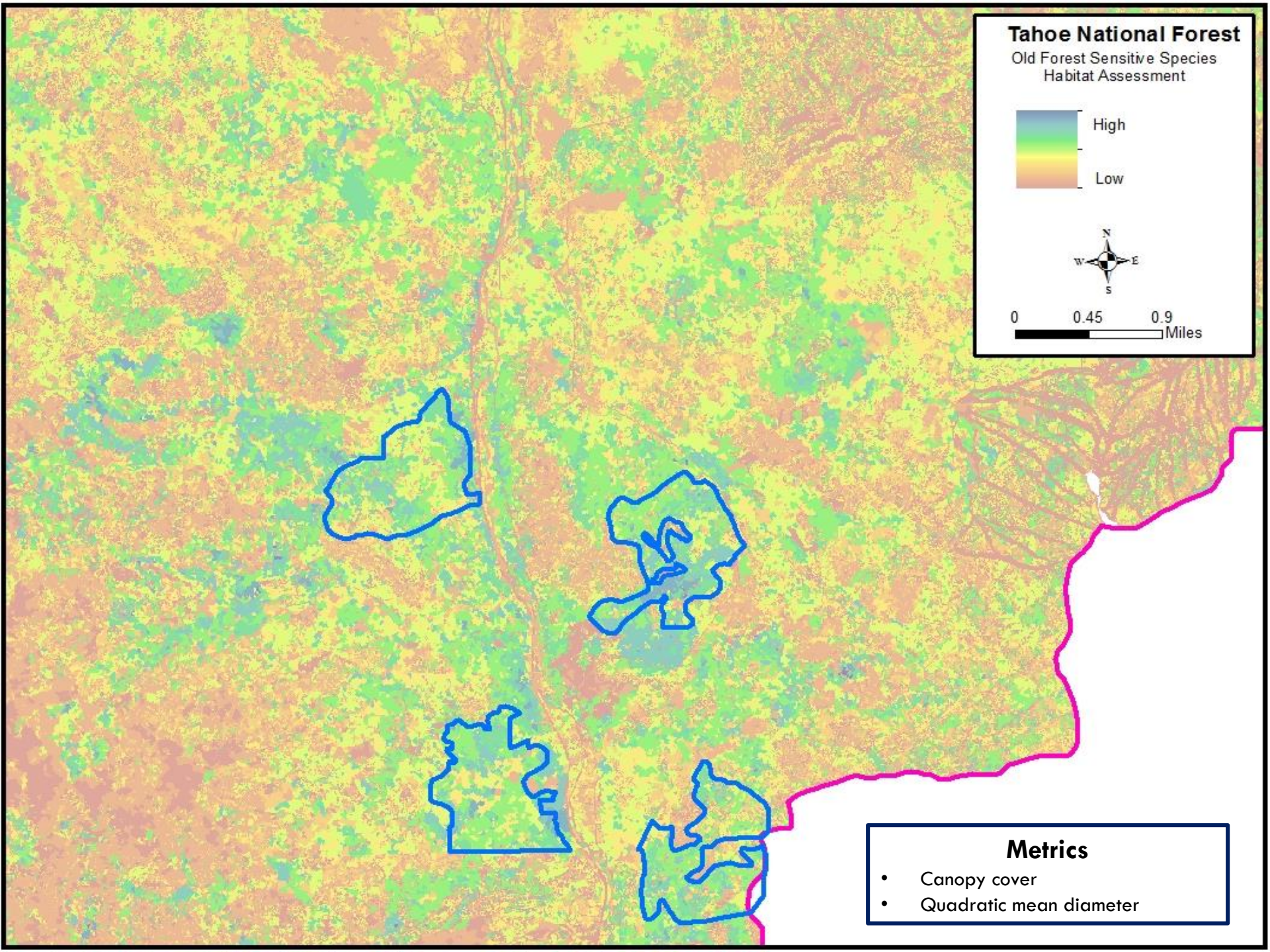
Miles
Metrics
• Canopy cover
• Quadratic mean diameter


Tahoe National Forest
Old Forest Sensitive Species
Habitat Assessment
High
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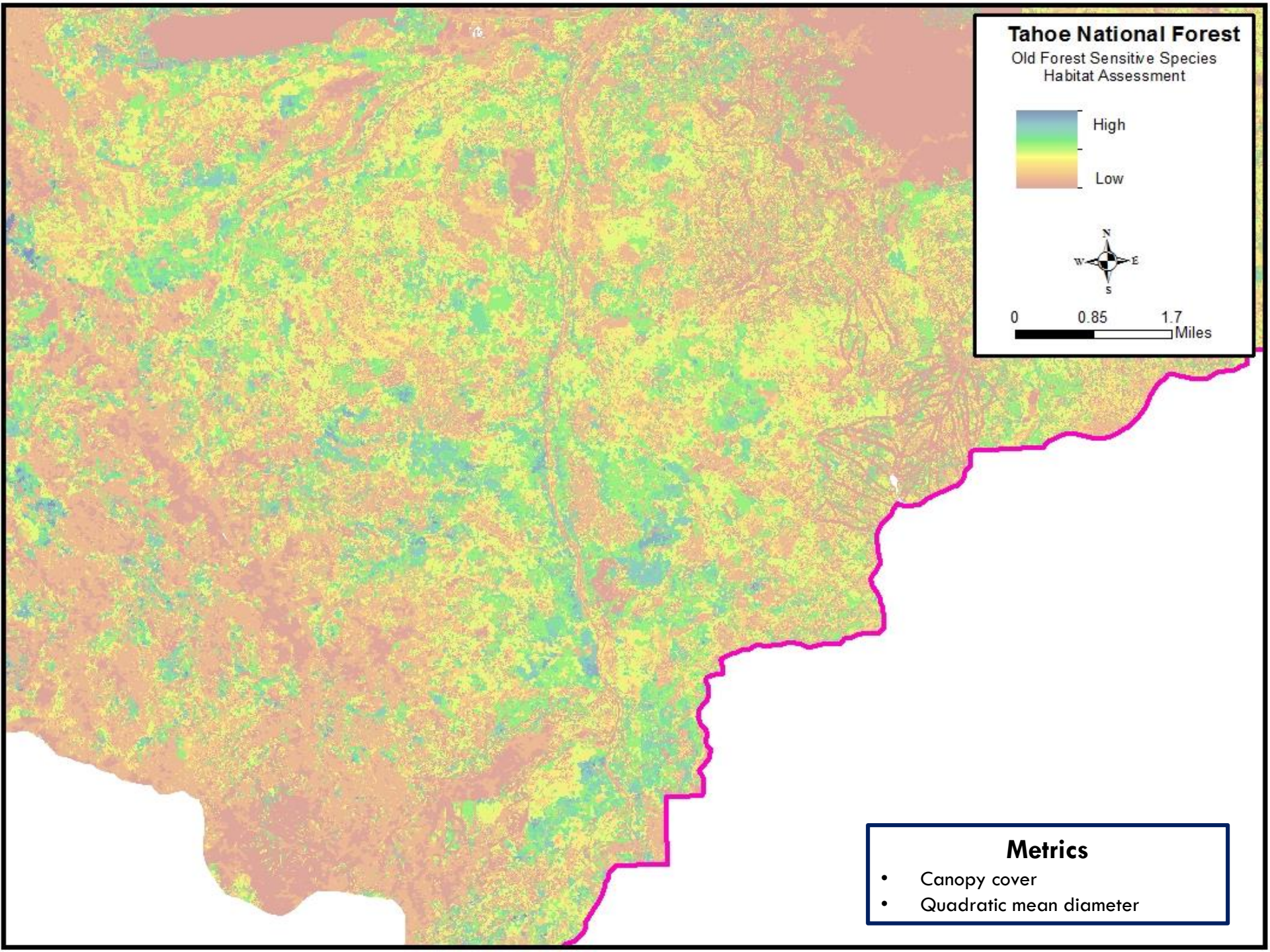
0.9
Miles
Metrics
• Canopy cover
• Quadratic mean diameter


Tahoe National Forest
Old Forest Sensitive Species
Habitat Assessment
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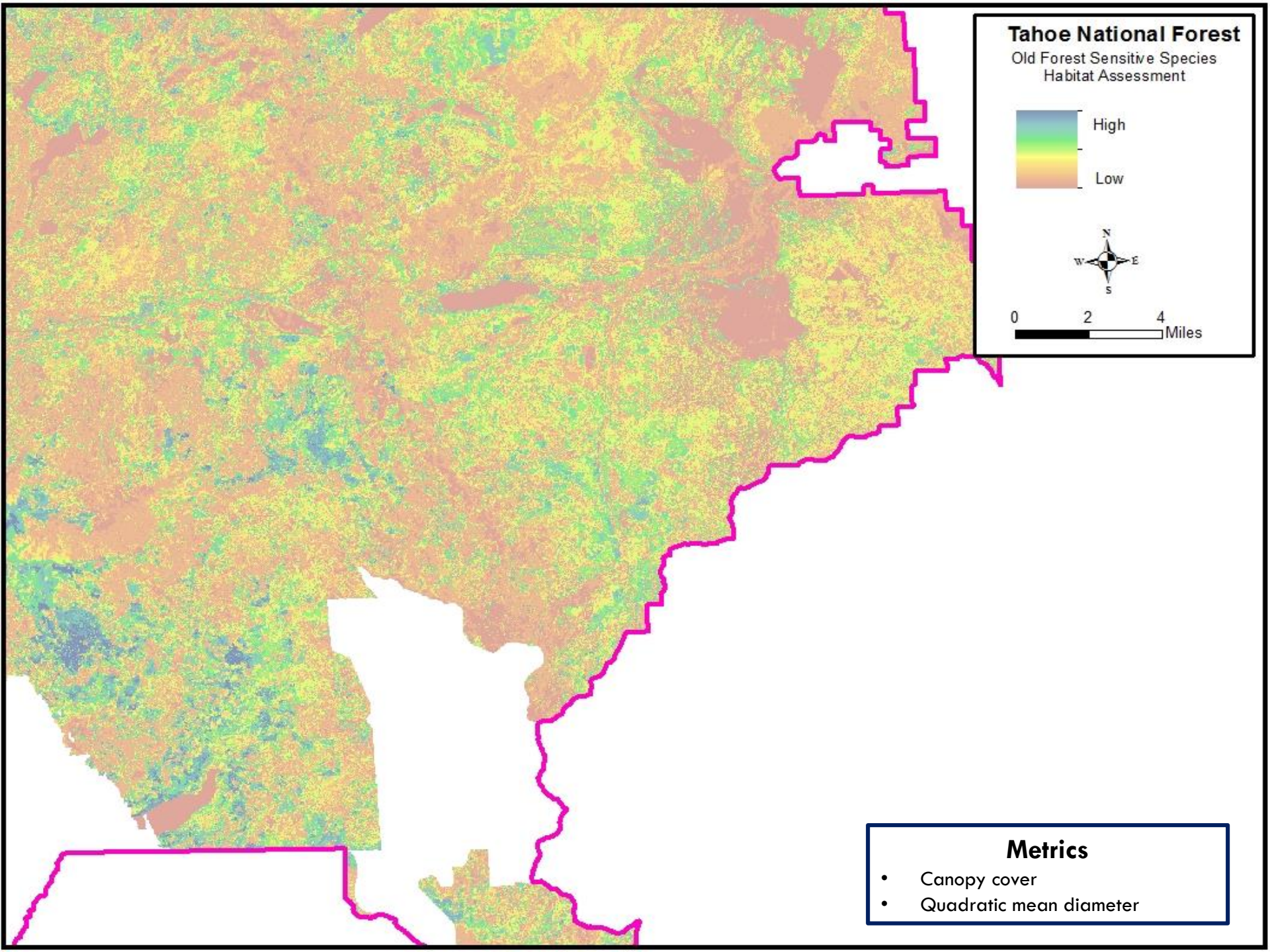
1.7
Miles
Metrics
• Canopy cover
• Quadratic mean diameter


Tahoe National Forest
Old Forest Sensitive Species
Habitat Assessment
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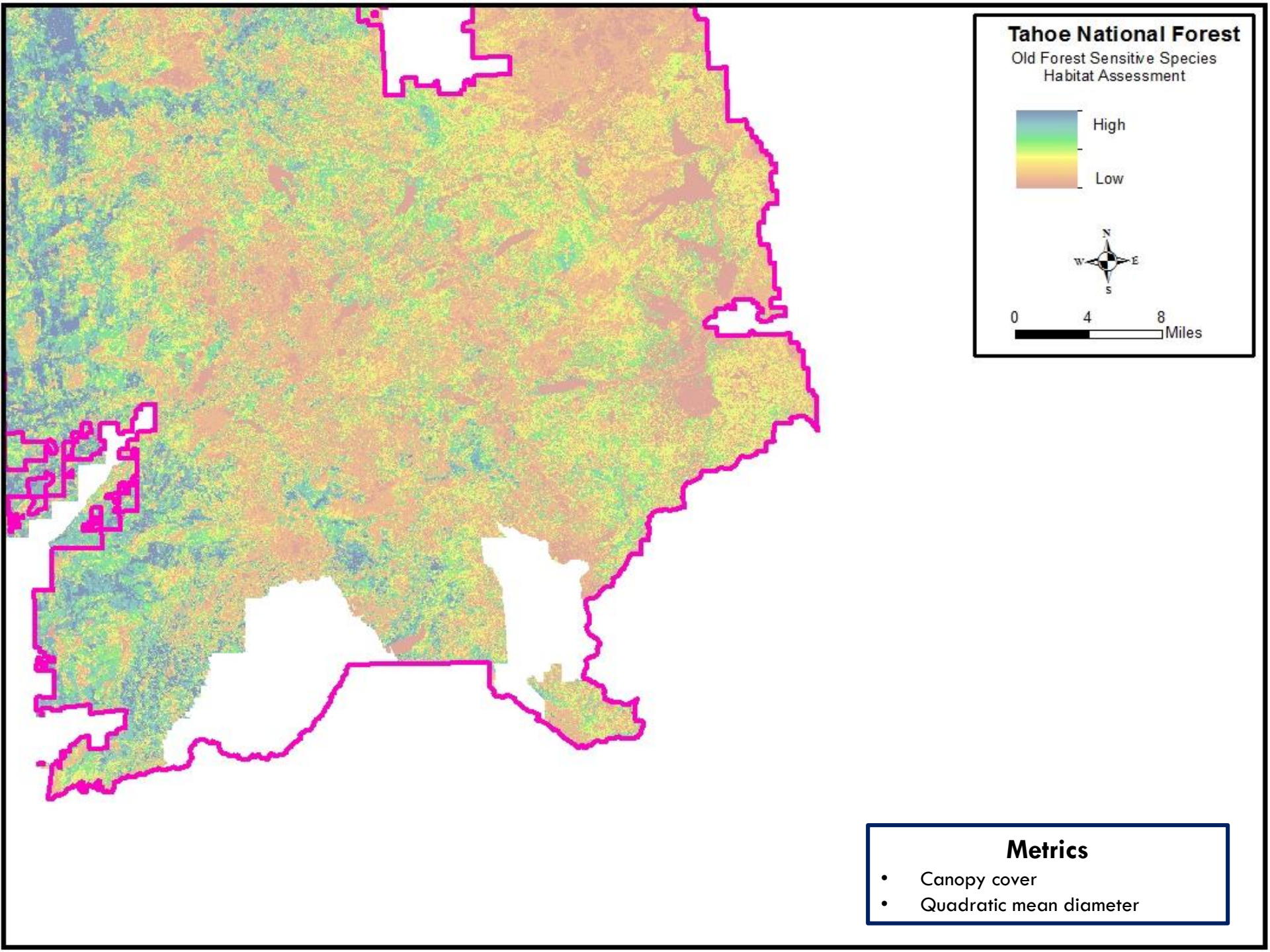
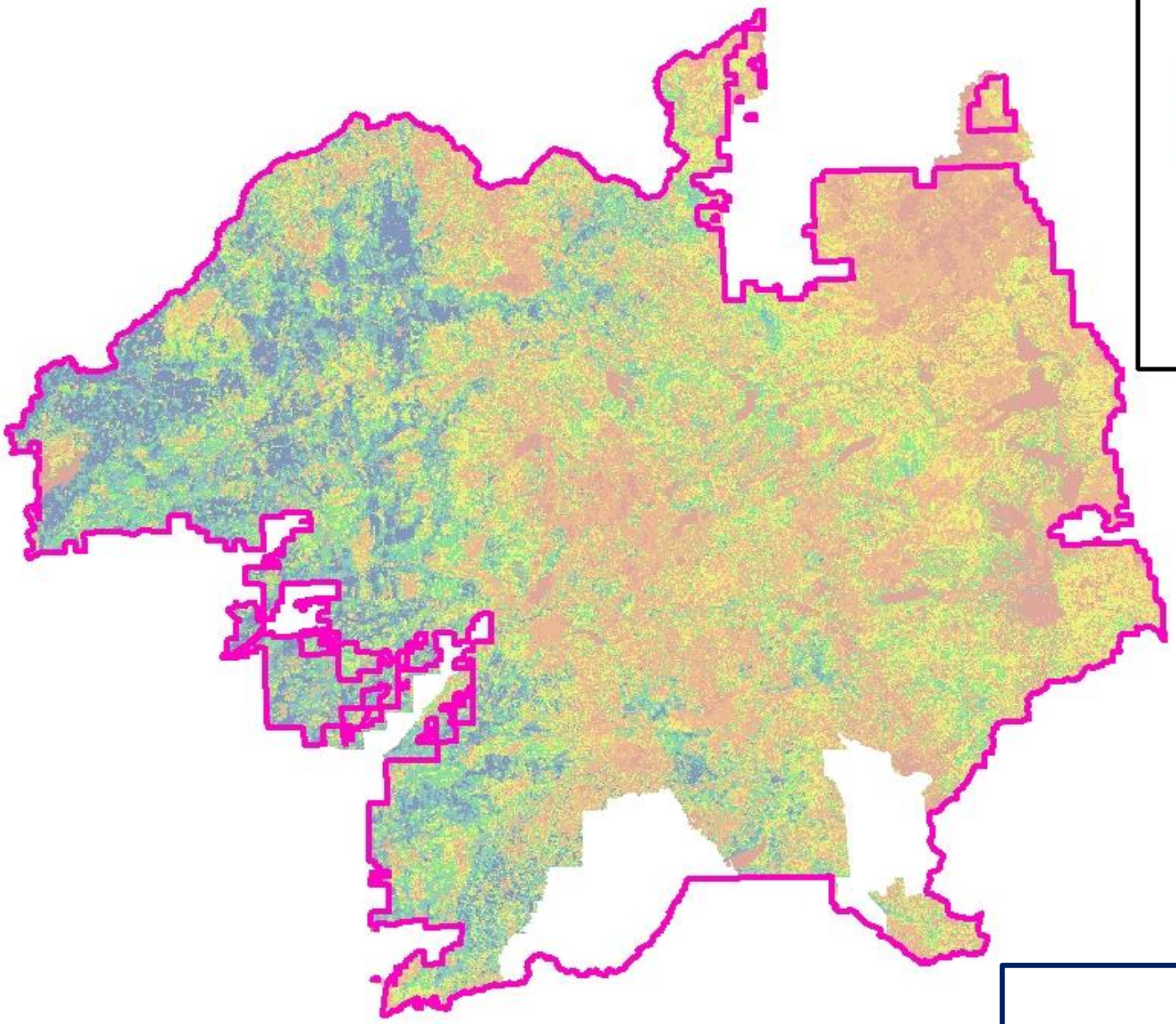
Metrics
• Canopy cover
• Quadratic mean diameter



Metrics

- Canopy cover
- Quadratic mean diameter

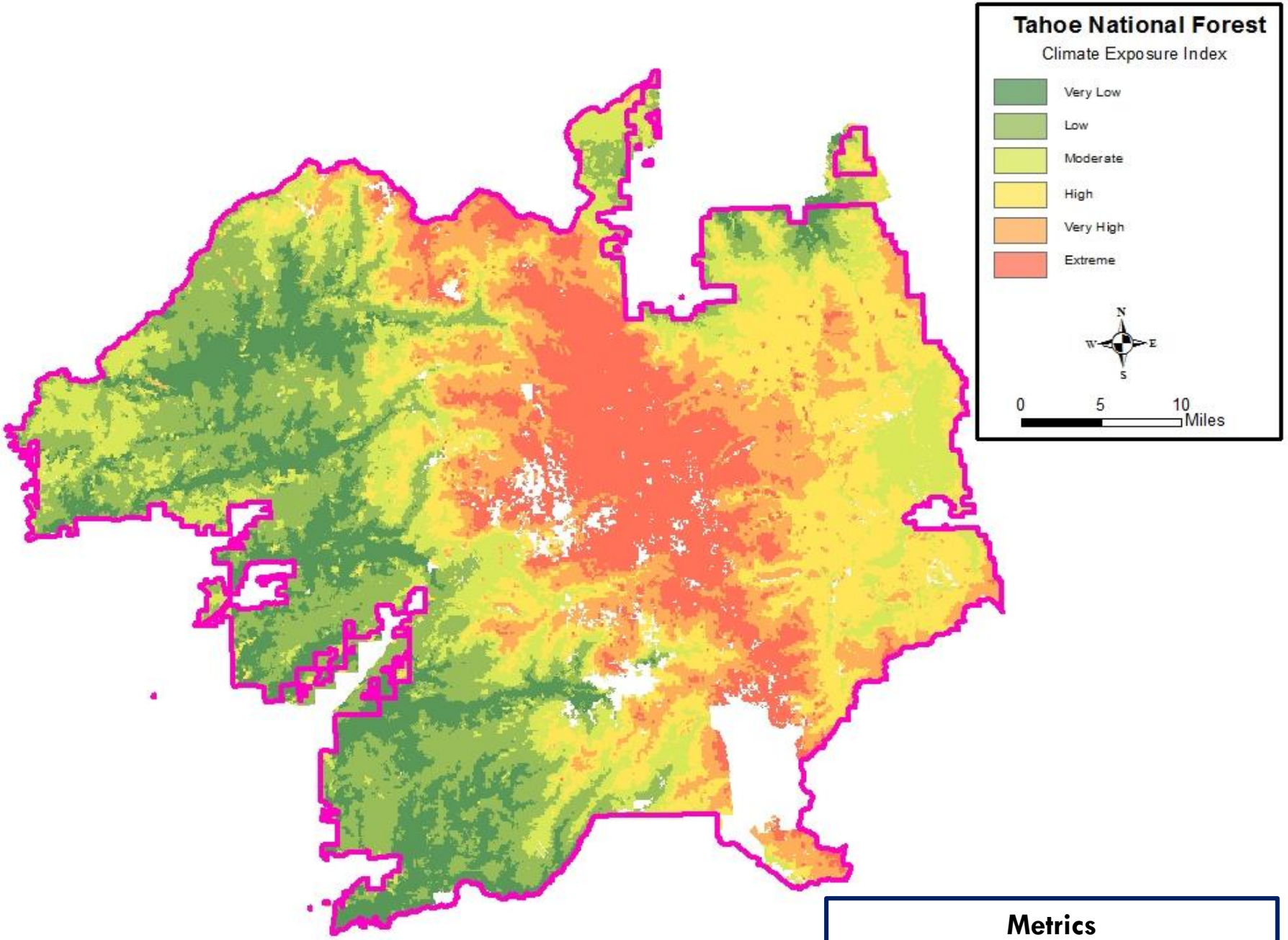


Metrics

- Canopy cover
- Quadratic mean diameter

LANDSCAPE ASSESSMENT

- Seamless transition between scales
- Seamless transition between metrics

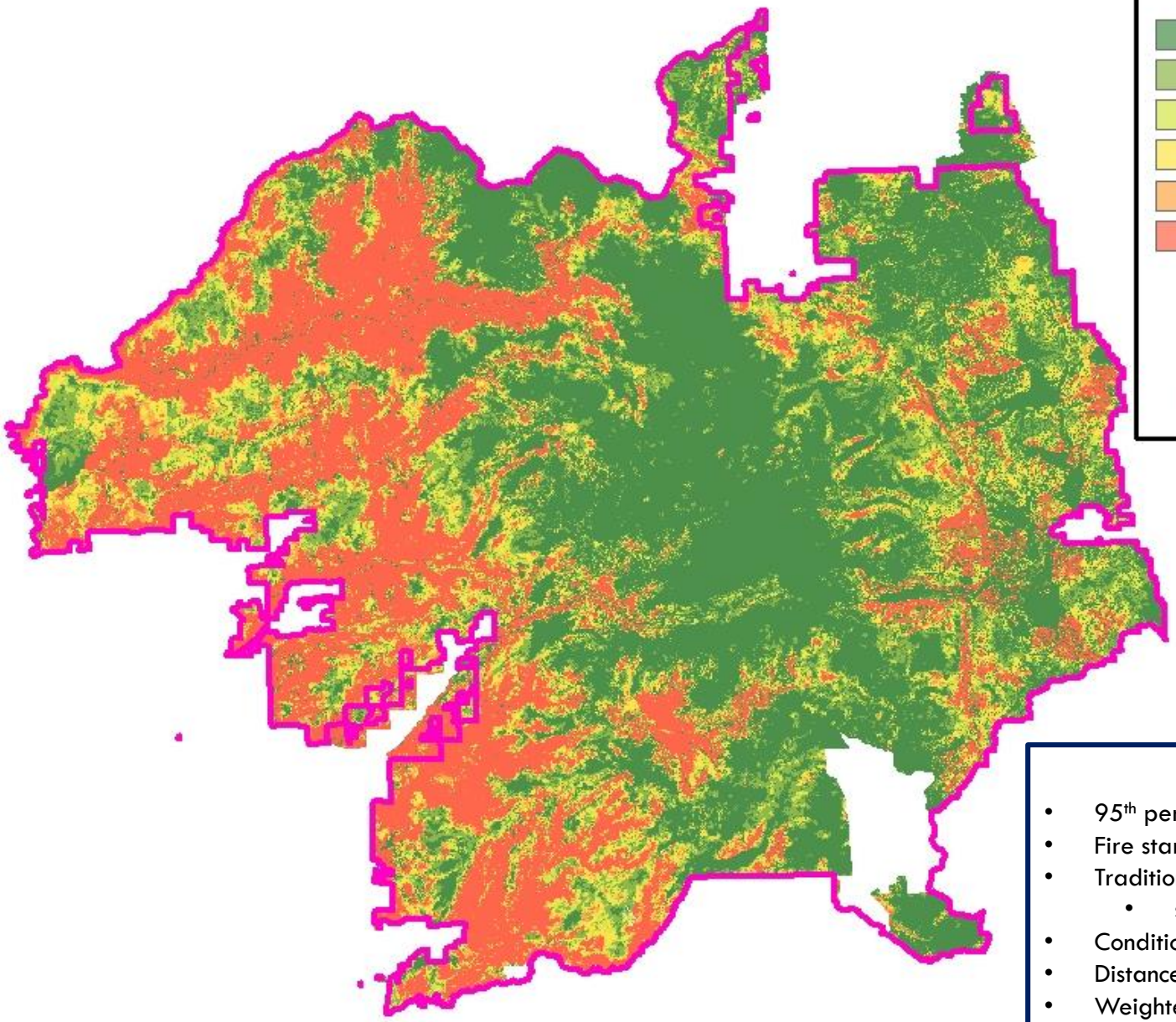


Metrics

- % climatic water deficit change
- Present 30 yr avg vs 2070 – 2099 avg

Credits:

Jim Thorne – U.C. Davis



Metrics

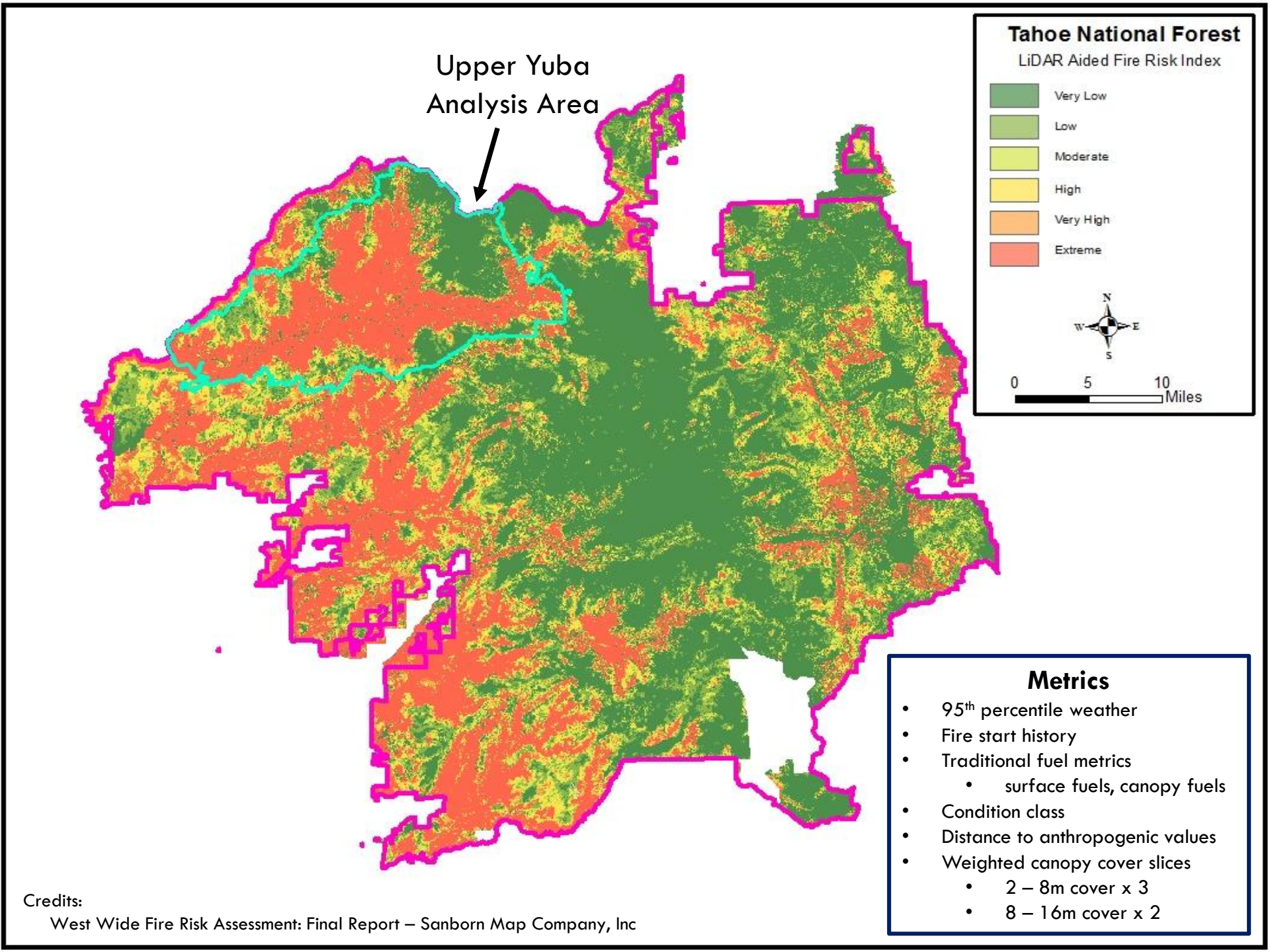
- 95th percentile weather
- Fire start history
- Traditional fuel metrics
  - surface fuels, canopy fuels
- Condition class
- Distance to anthropogenic values
- Weighted canopy cover slices
  - 2 – 8m cover x 3
  - 8 – 16m cover x 2

Credits:

West Wide Fire Risk Assessment: Final Report – Sanborn Map Company, Inc

LANDSCAPE ASSESSMENT

- Seamless transition between scales
- Seamless transition between metrics
- Simplified queries enables analysis without an analyst



Metrics

- 95th percentile weather
- Fire start history
- Traditional fuel metrics
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- Distance to anthropogenic values
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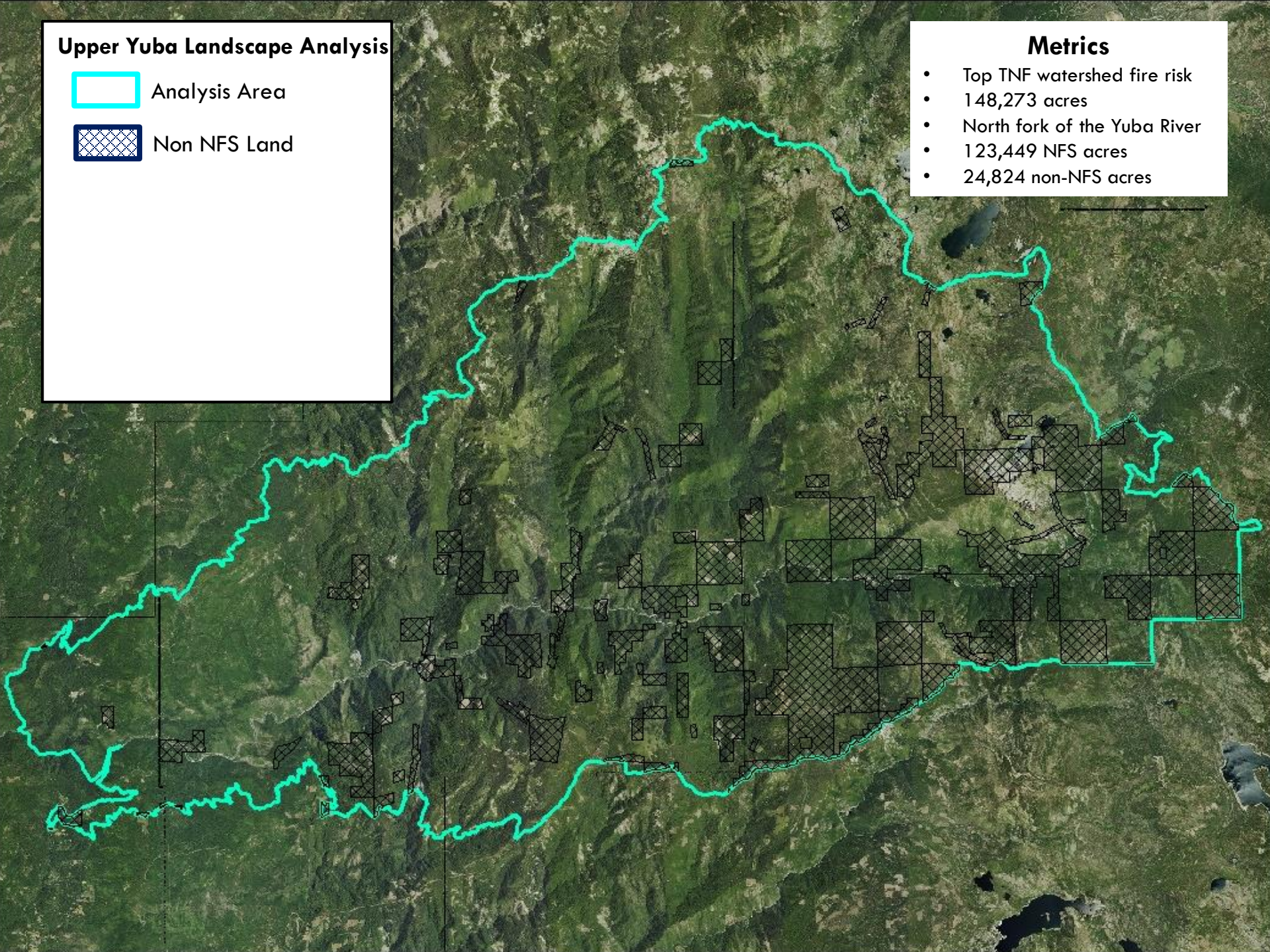
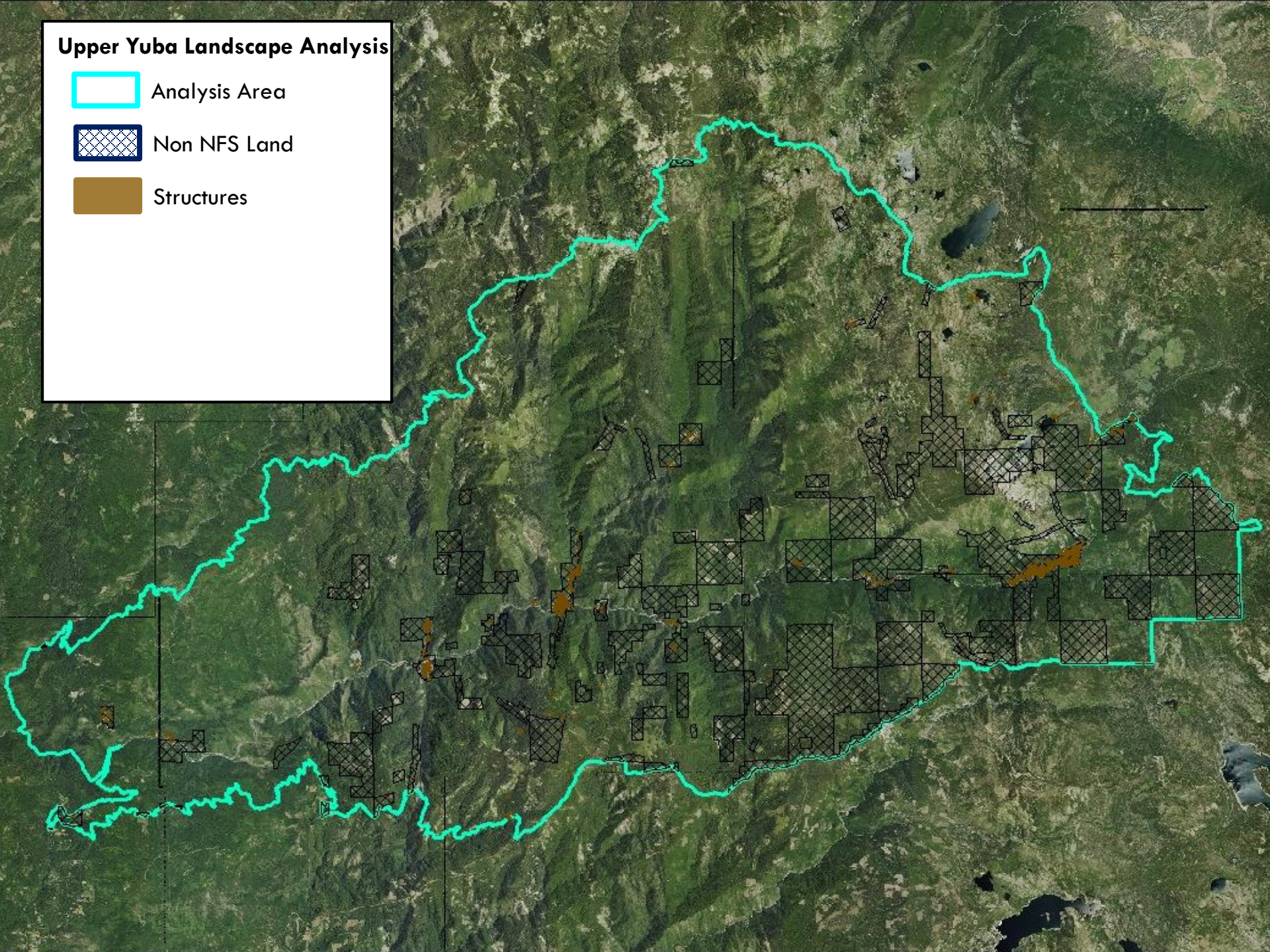
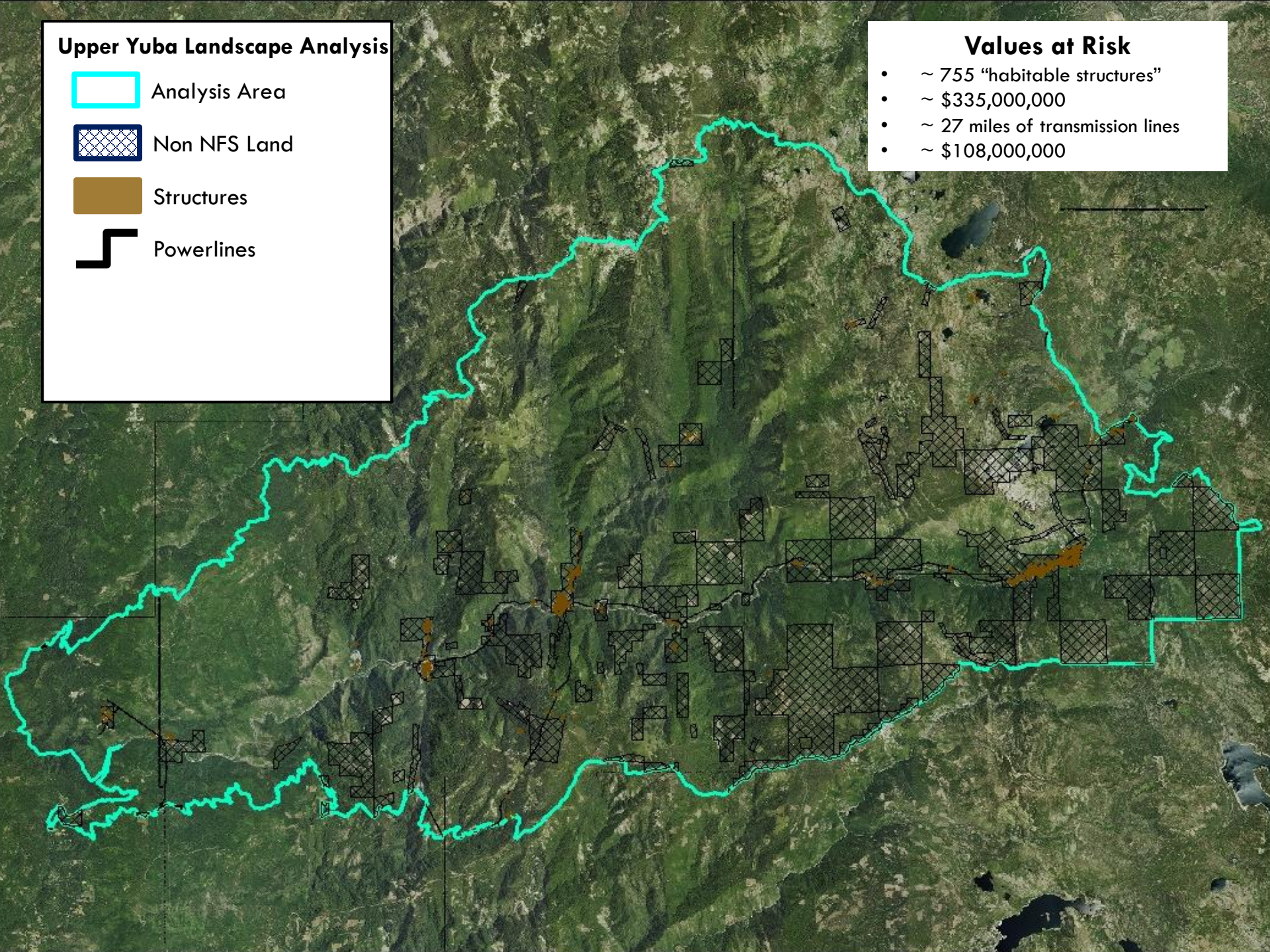
  - 2 – 8m cover x 3
  - 8 – 16m cover x 2

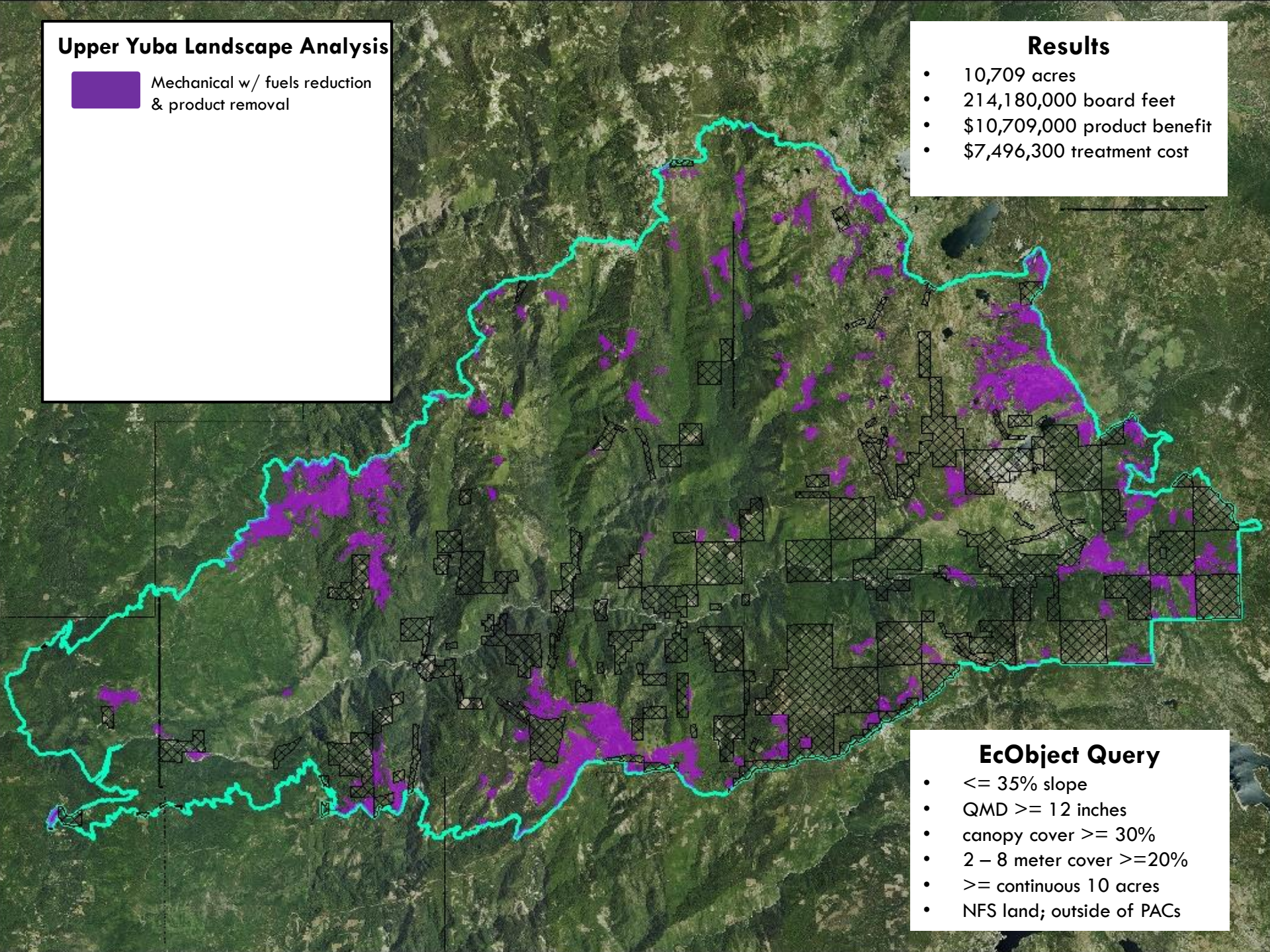
Credits:

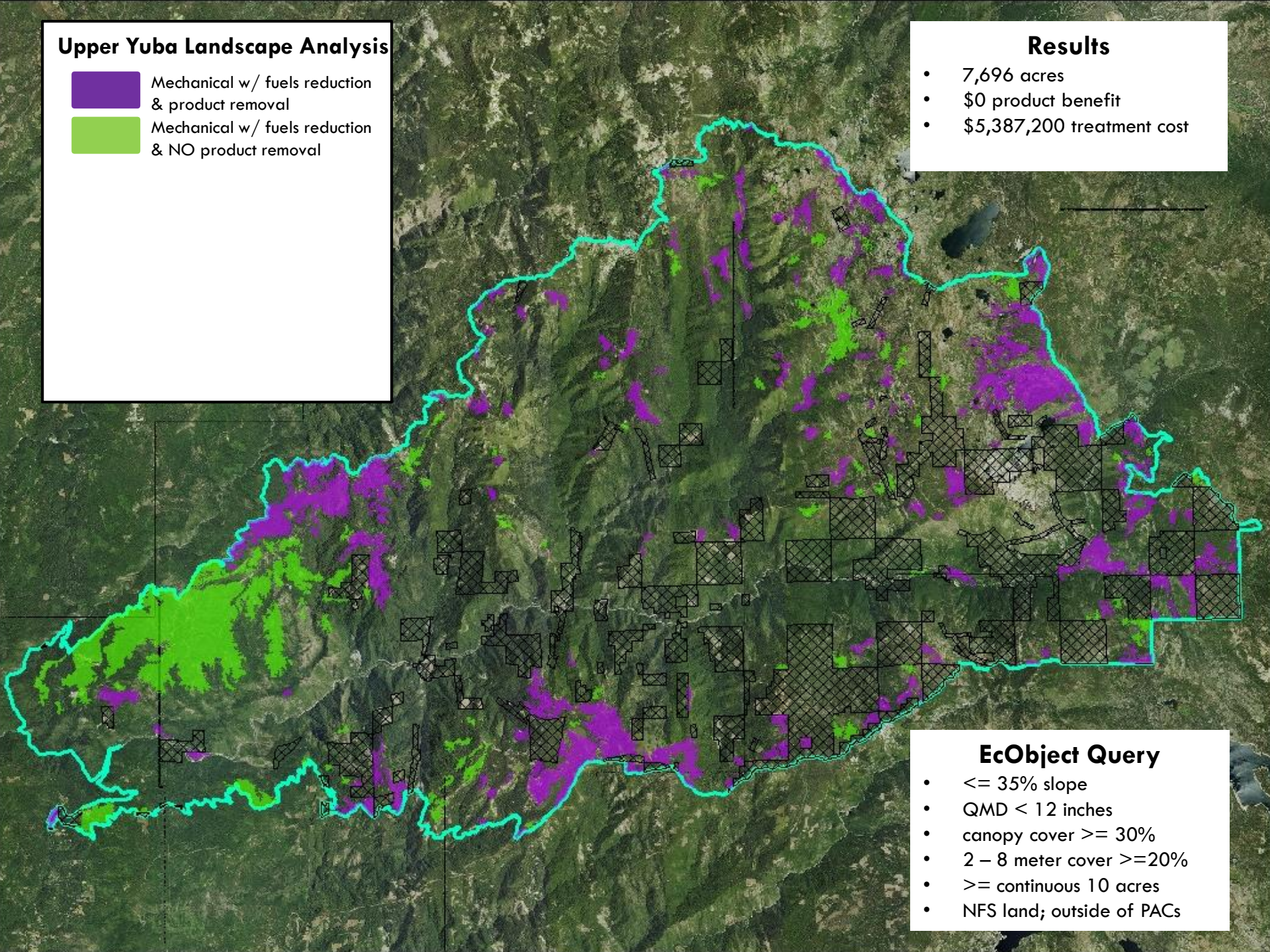
West Wide Fire Risk Assessment: Final Report – Sanborn Map Company, Inc

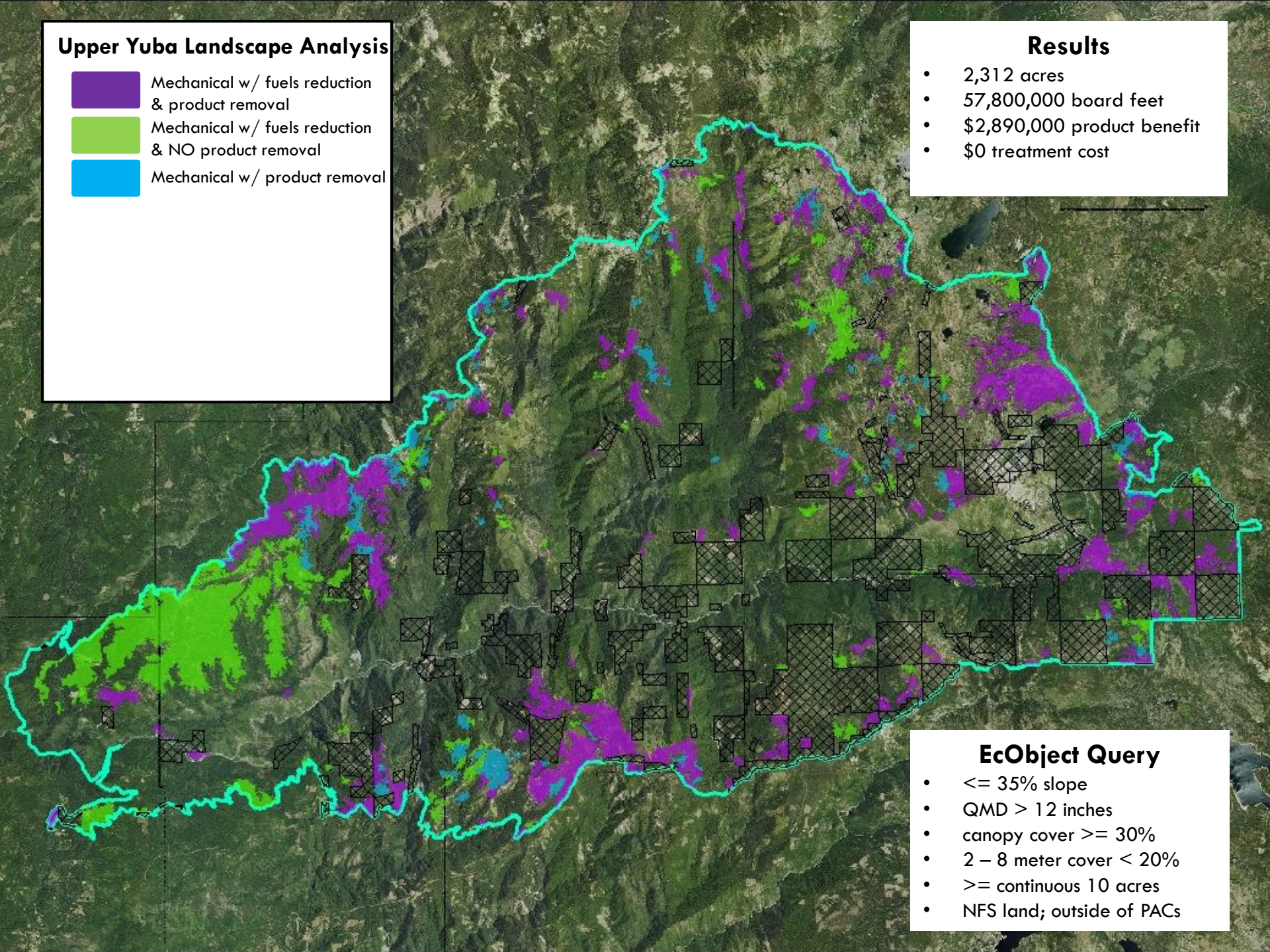

Upper Yuba Landscape Analysis
Analysis Area
Non NFS Land
Metrics
Top TNF watershed fire risk
148,273 acres
North fork of the Yuba River
123,449 NFS acres
24,824 non-NFS acres

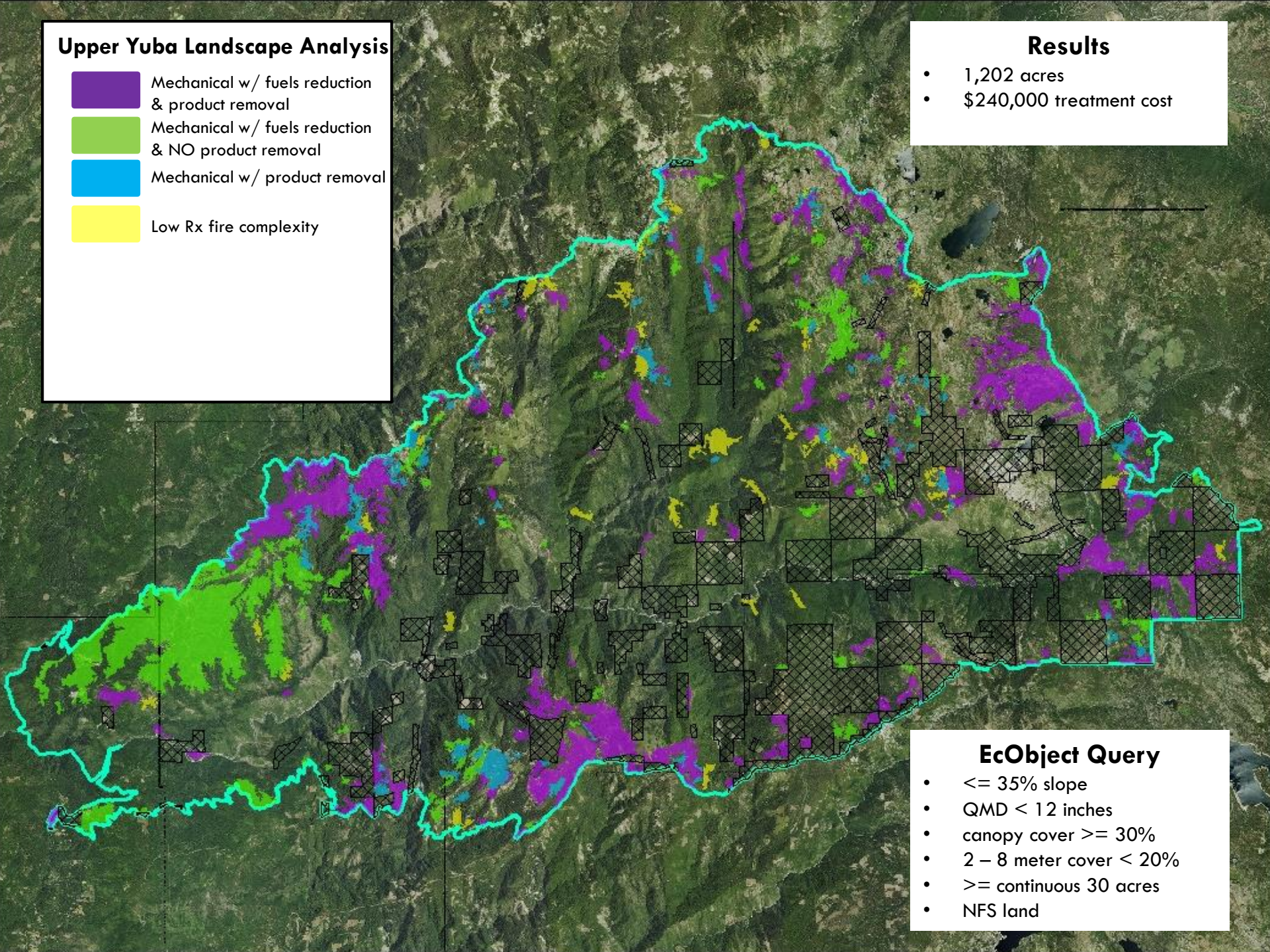

Upper Yuba Landscape Analysis
Analysis Area
Non NFS Land
Structures

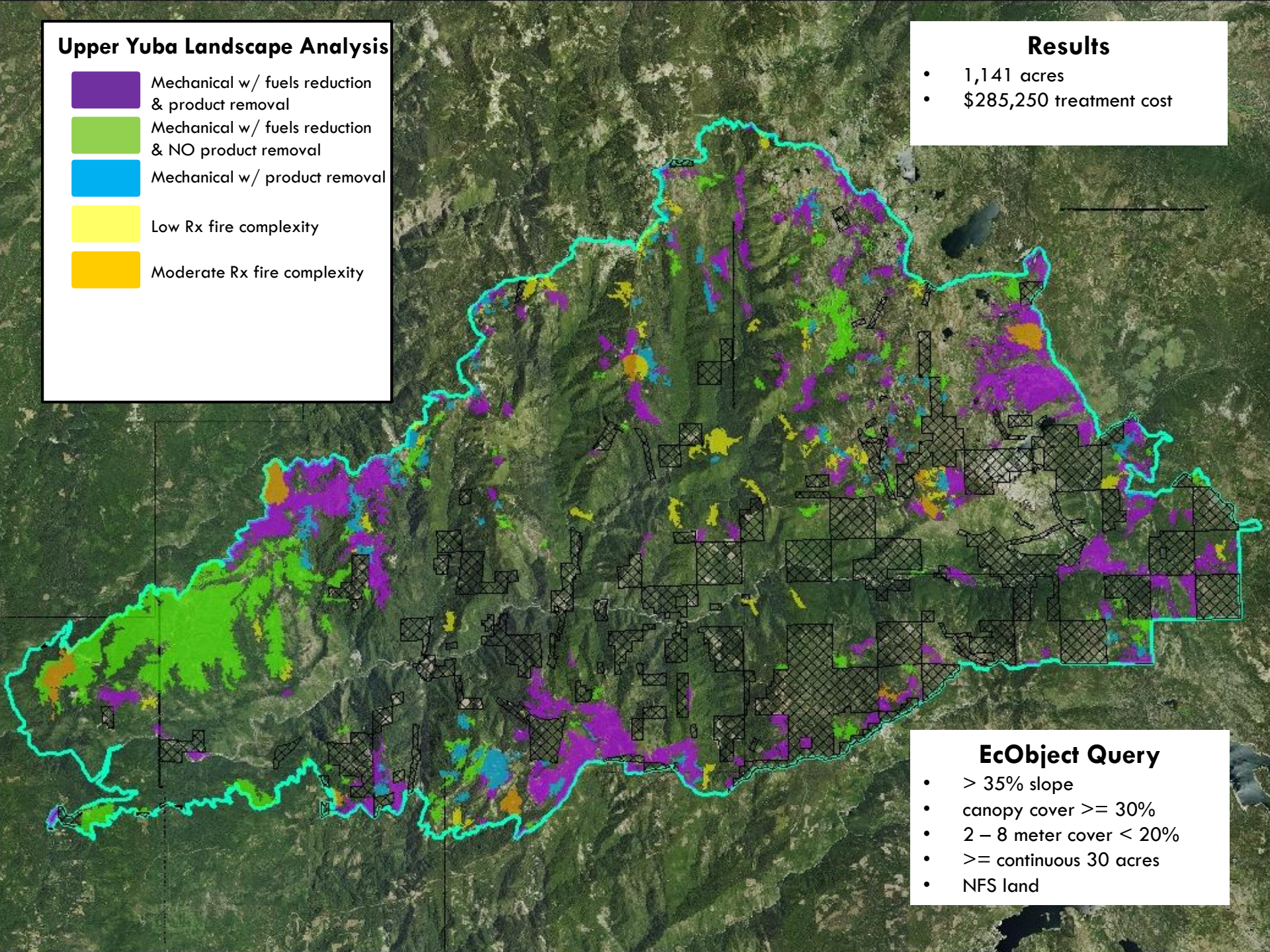

Upper Yuba Landscape Analysis
Analysis Area
Non NFS Land
Structures
Powerlines
Values at Risk
~ 755 "habitable structures"
~ $335,000,000
~ 27 miles of transmission lines
~ $108,000,000

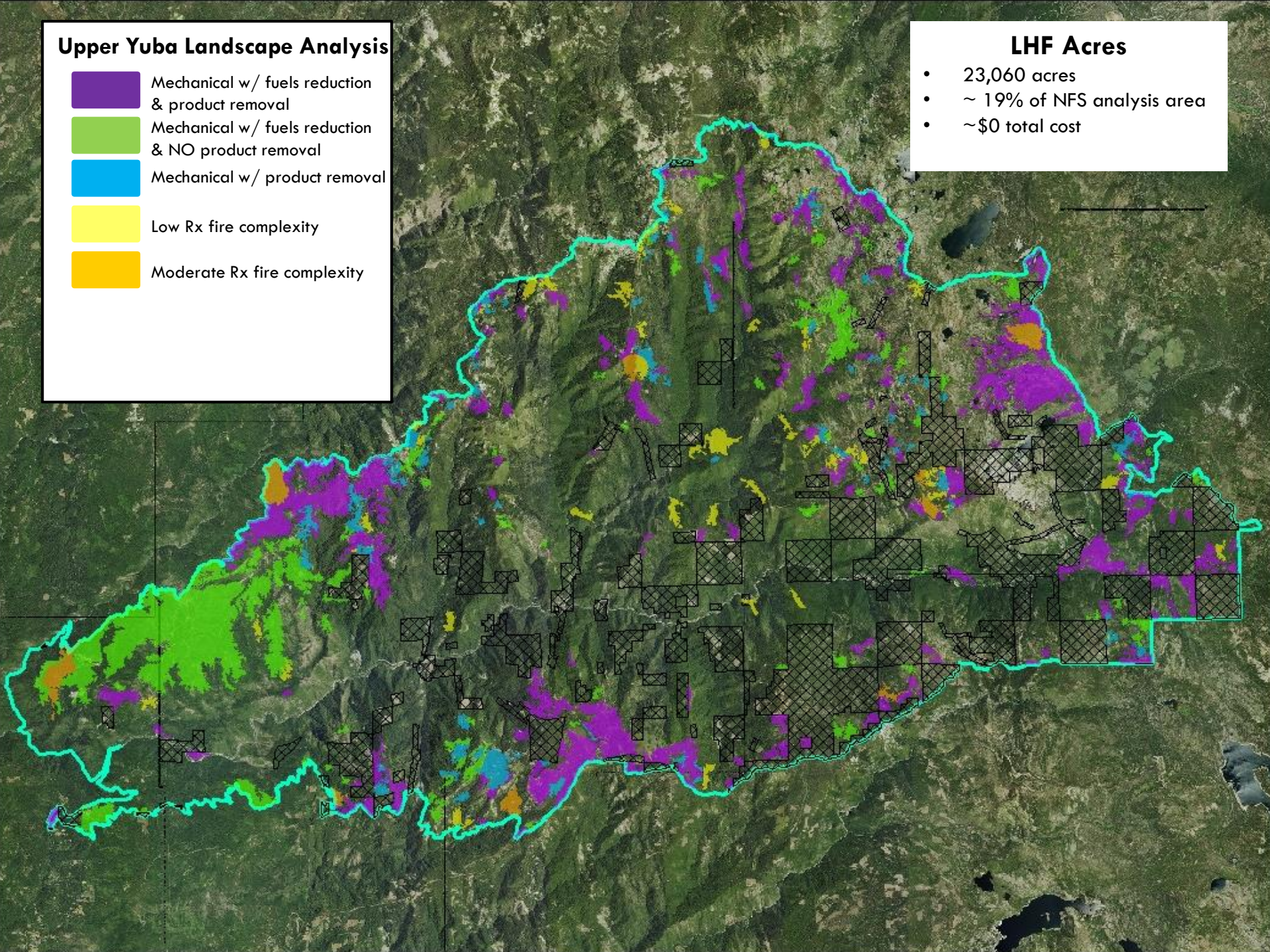

Upper Yuba Landscape Analysis
Mechanical w/ fuels reduction & product removal
Results
• 10,709 acres
• 214,180,000 board feet
• $10,709,000 product benefit
• $7,496,300 treatment cost
EcObject Query
• <= 35% slope
• QMD >= 12 inches
• canopy cover >= 30%
• 2 – 8 meter cover >=20%
• >= continuous 10 acres
• NFS land; outside of PACs

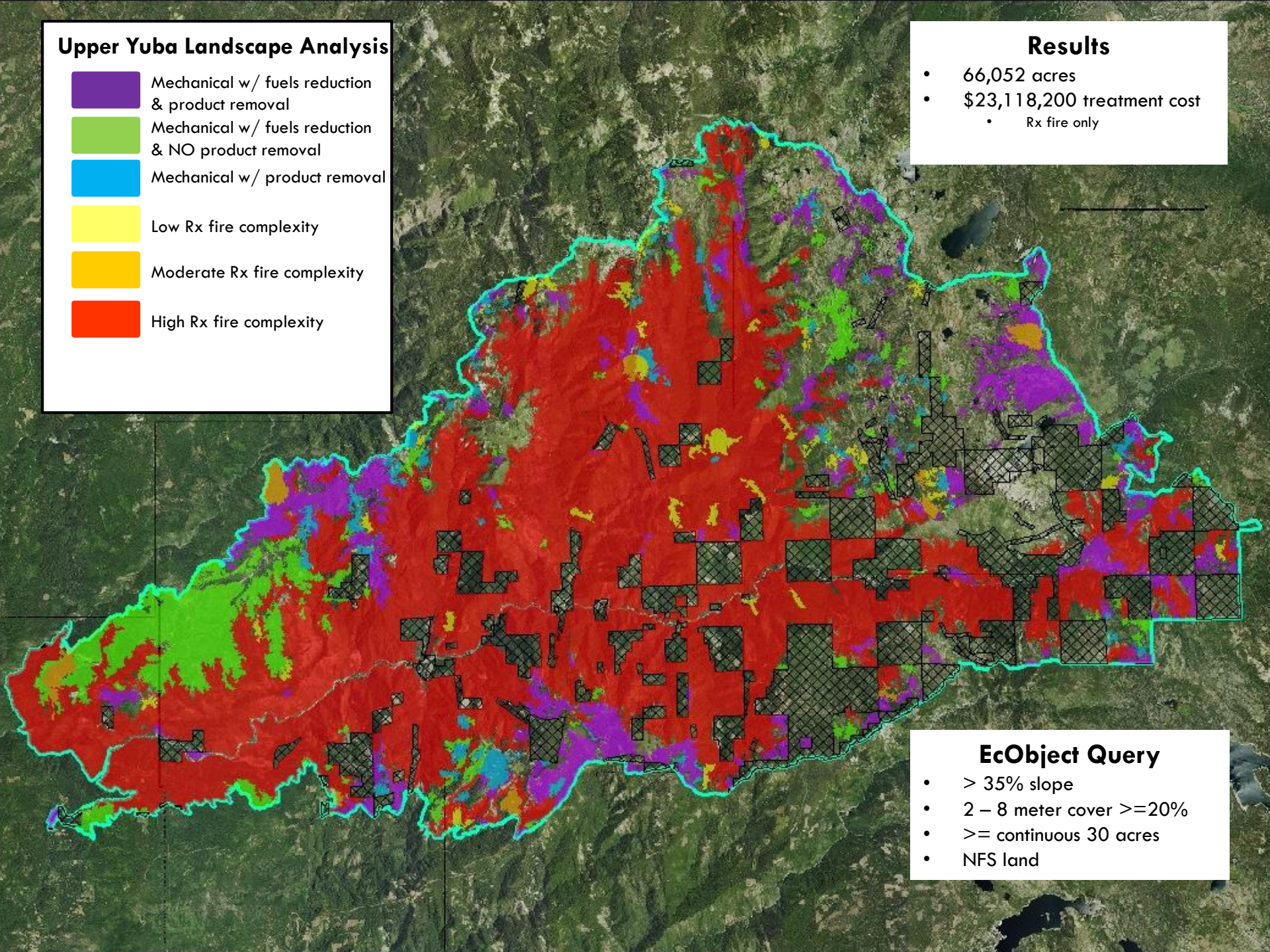

Upper Yuba Landscape Analysis
Mechanical w/ fuels reduction & product removal
Mechanical w/ fuels reduction & NO product removal
Results
• 7,696 acres
• $0 product benefit
• $5,387,200 treatment cost
EcObject Query
• <= 35% slope
• QMD < 12 inches
• canopy cover >= 30%
• 2 – 8 meter cover >=20%
• >= continuous 10 acres
• NFS land; outside of PACs

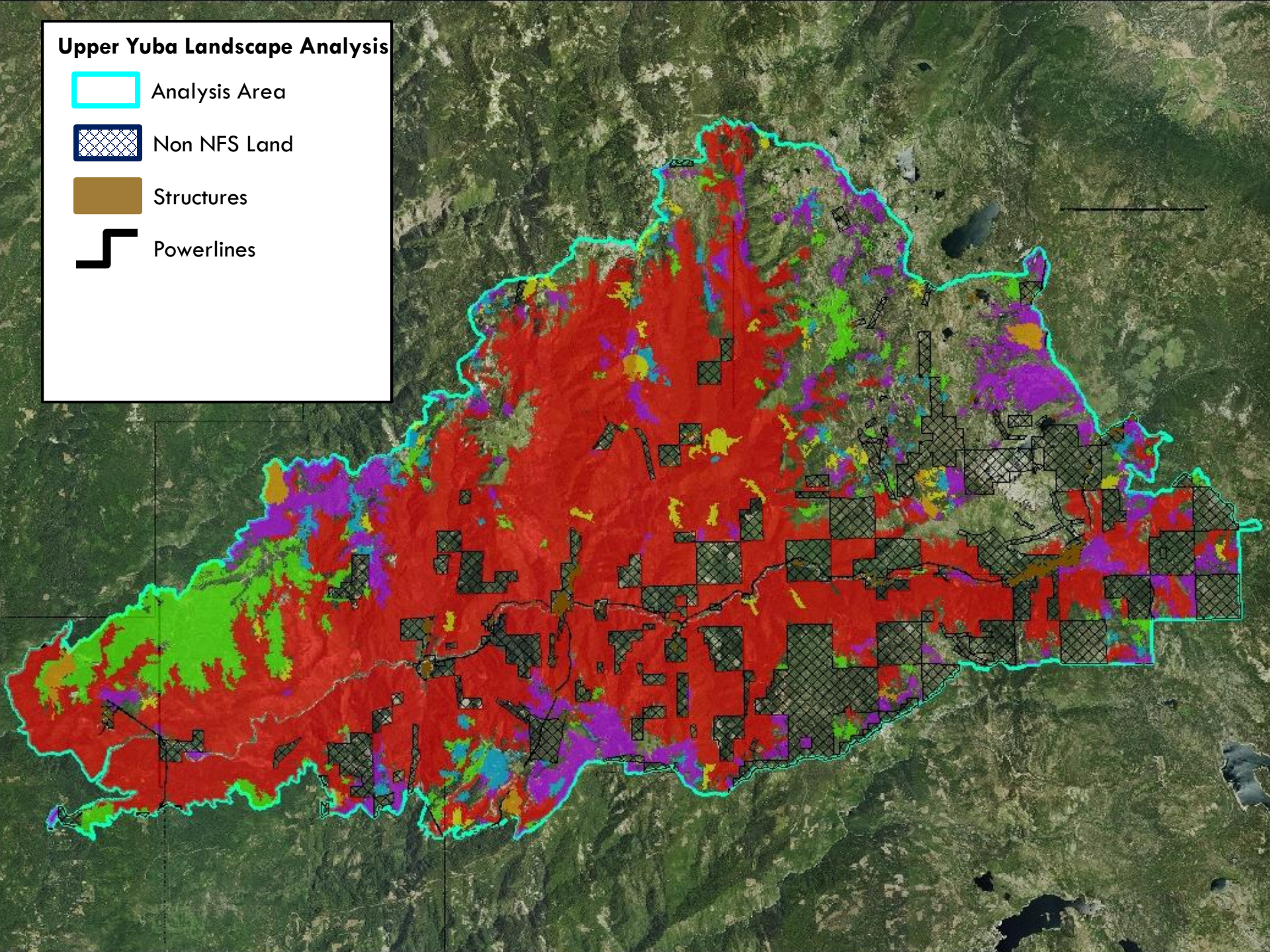

Upper Yuba Landscape Analysis
Mechanical w/ fuels reduction & product removal
Mechanical w/ fuels reduction & NO product removal
Mechanical w/ product removal
Results
2,312 acres
57,800,000 board feet
$2,890,000 product benefit
$0 treatment cost
EcObject Query
<= 35% slope
QMD > 12 inches
canopy cover >= 30%
2 – 8 meter cover < 20%
>= continuous 10 acres
NFS land; outside of PACs

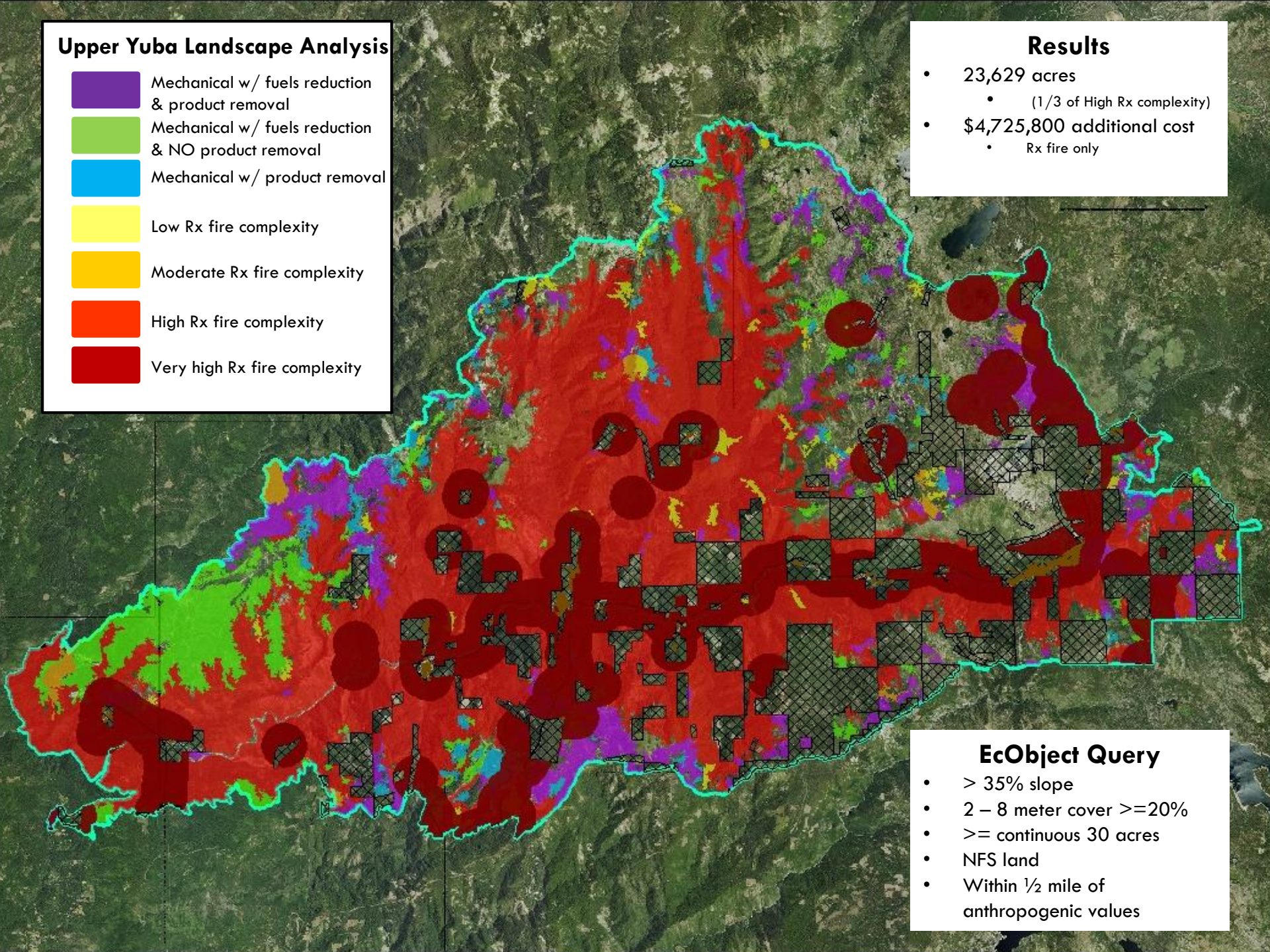

Upper Yuba Landscape Analysis
Mechanical w/ fuels reduction & product removal
Mechanical w/ fuels reduction & NO product removal
Mechanical w/ product removal
Low Rx fire complexity
Results
• 1,202 acres
• $240,000 treatment cost
EcObject Query
• <= 35% slope
• QMD < 12 inches
• canopy cover >= 30%
• 2 – 8 meter cover < 20%
• >= continuous 30 acres
• NFS land

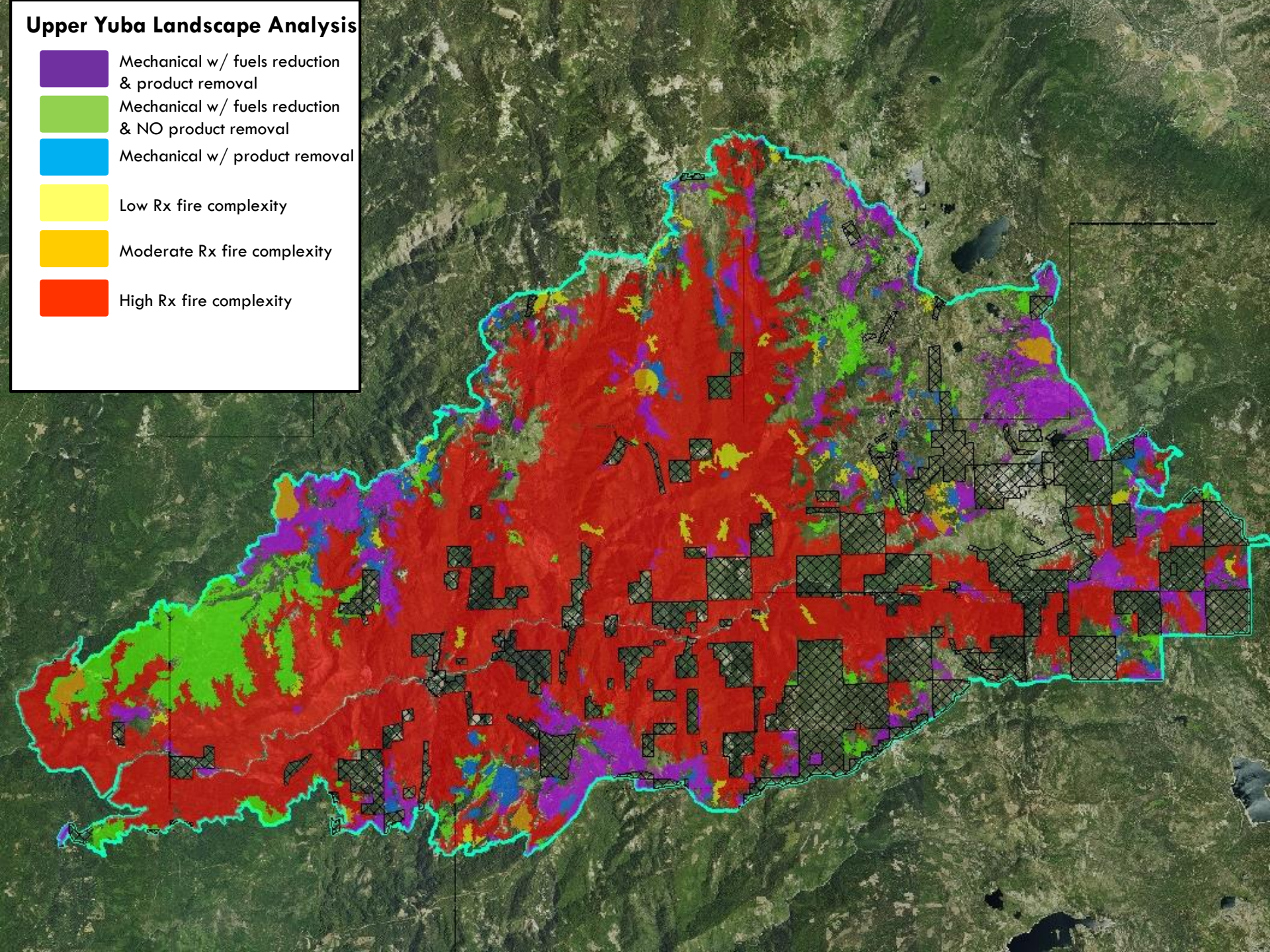

Upper Yuba Landscape Analysis
Mechanical w/ fuels reduction & product removal
Mechanical w/ fuels reduction & NO product removal
Mechanical w/ product removal
Low Rx fire complexity
Moderate Rx fire complexity
Results
• 1,141 acres
• $285,250 treatment cost
EcObject Query
• > 35% slope
• canopy cover >= 30%
• 2 – 8 meter cover < 20%
• >= continuous 30 acres
• NFS land


Upper Yuba Landscape Analysis
Mechanical w/ fuels reduction & product removal
Mechanical w/ fuels reduction & NO product removal
Mechanical w/ product removal
Low Rx fire complexity
Moderate Rx fire complexity
LHF Acres
• 23,060 acres
• ~ 19% of NFS analysis area
• ~$0 total cost


Upper Yuba Landscape Analysis
Mechanical w/ fuels reduction & product removal
Mechanical w/ fuels reduction & NO product removal
Mechanical w/ product removal
Low Rx fire complexity
Moderate Rx fire complexity
High Rx fire complexity
Results
66,052 acres
$23,118,200 treatment cost
Rx fire only
EcObject Query
> 35% slope
2 – 8 meter cover >=20%
>= continuous 30 acres
NFS land


Upper Yuba Landscape Analysis
Analysis Area
Non NFS Land
Structures
Powerlines


Upper Yuba Landscape Analysis
Mechanical w/ fuels reduction & product removal
Mechanical w/ fuels reduction & NO product removal
Mechanical w/ product removal
Low Rx fire complexity
Moderate Rx fire complexity
High Rx fire complexity
Very high Rx fire complexity
Results
23,629 acres
(1/3 of High Rx complexity)
$4,725,800 additional cost
Rx fire only
EcObject Query
> 35% slope
2 – 8 meter cover >=20%
>= continuous 30 acres
NFS land
Within ½ mile of anthropogenic values

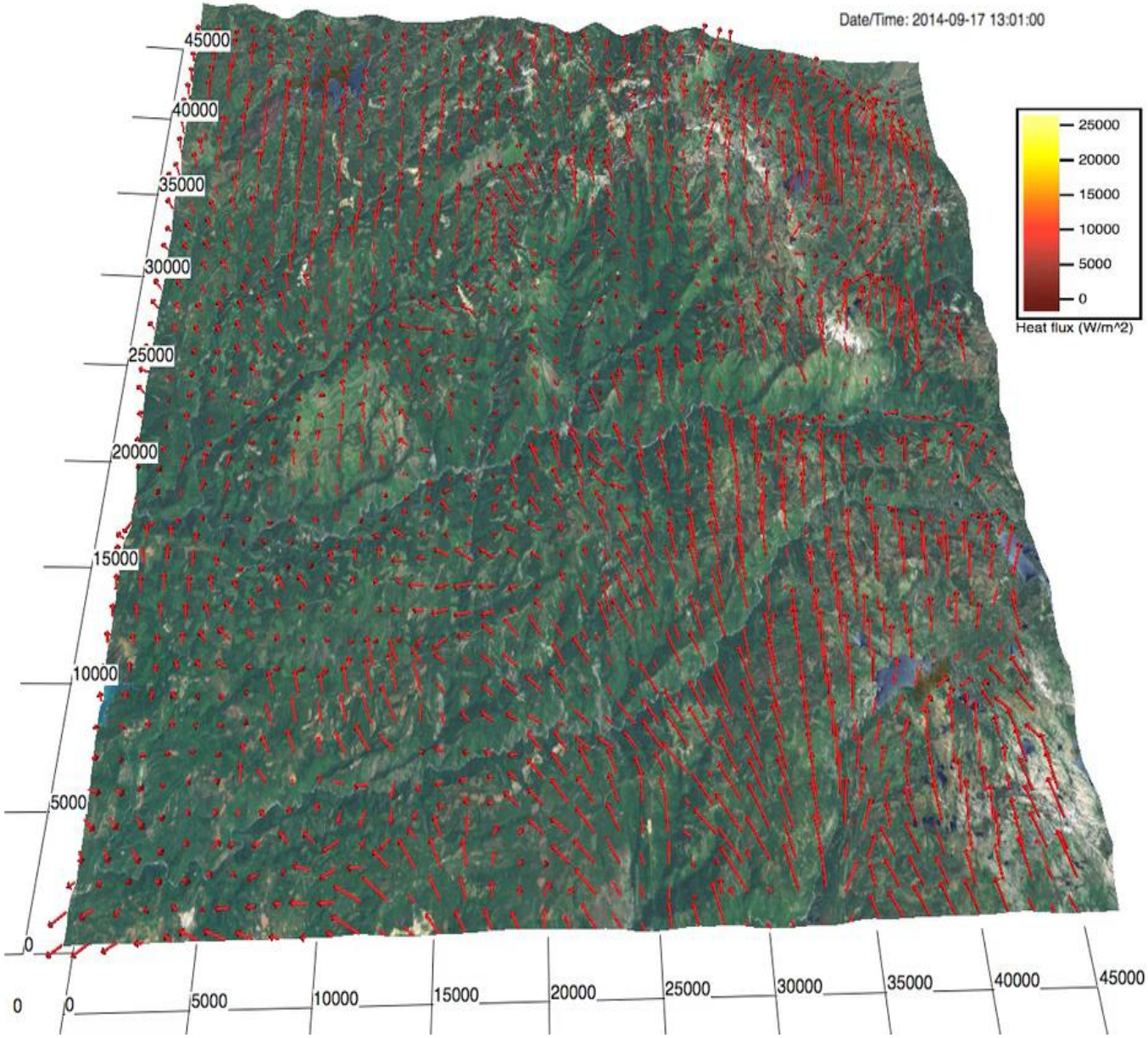

Upper Yuba Landscape Analysis
Mechanical w/ fuels reduction & product removal
Mechanical w/ fuels reduction & NO product removal
Mechanical w/ product removal
Low Rx fire complexity
Moderate Rx fire complexity
High Rx fire complexity

Couple Atmosphere Wildland Fire Environment (CAWFE)

Goodyear Bar Fire
Tahoe National Forest

Wind direction/speed

- Developed in response to current fire models inability to predict large or mega fire growth
- CAWFE combines a numerical weather prediction model and a fire behavior model that simulates the growth of a wildfire in response to weather, fuel conditions, and terrain
- These models are two-way coupled to constantly exchange information that creates a positive feed back loop of weather influencing fire behavior and then the fire influencing weather – winds, humidity



Credits:
Janice Coen – National Center for Atmospheric Research
Natasha Stavoros – NASA's Jet Propulsion Lab
Josephine Fite-Kaufman – USFS Region 5 Planning Team

Couple Atmosphere Wildland Fire Environment (CAWFE)

Goodyear Bar Fire
Tahoe National Forest

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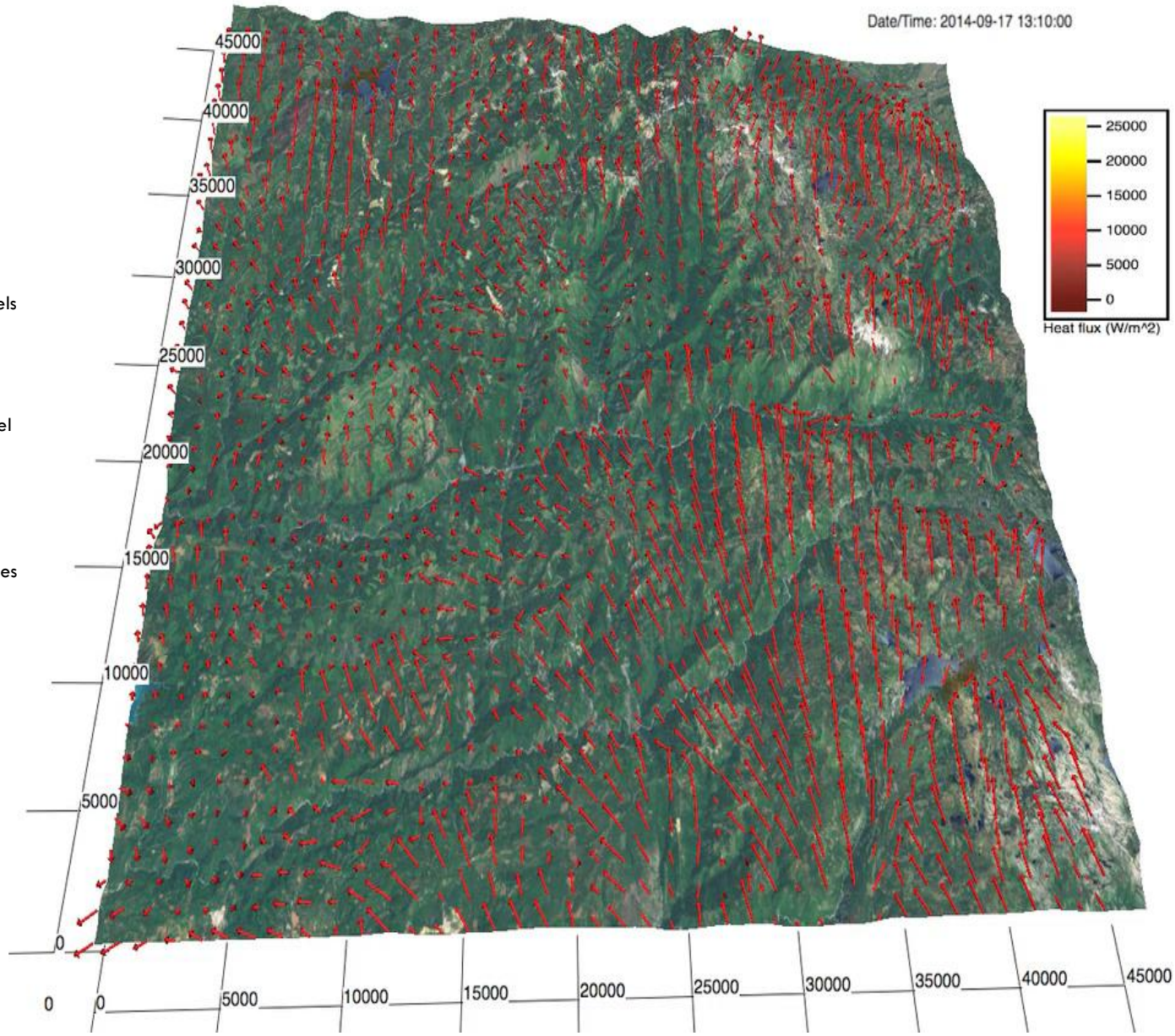
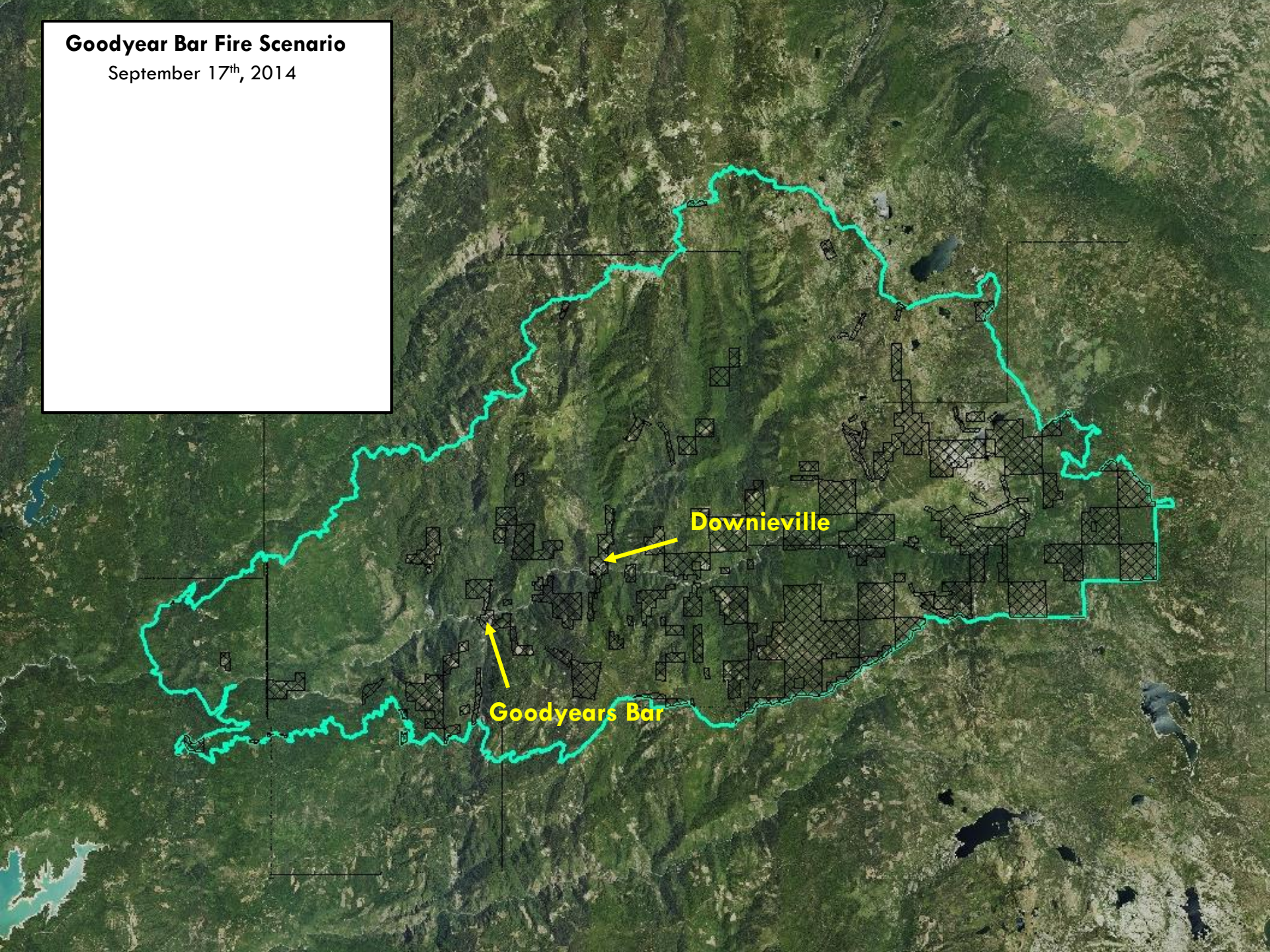
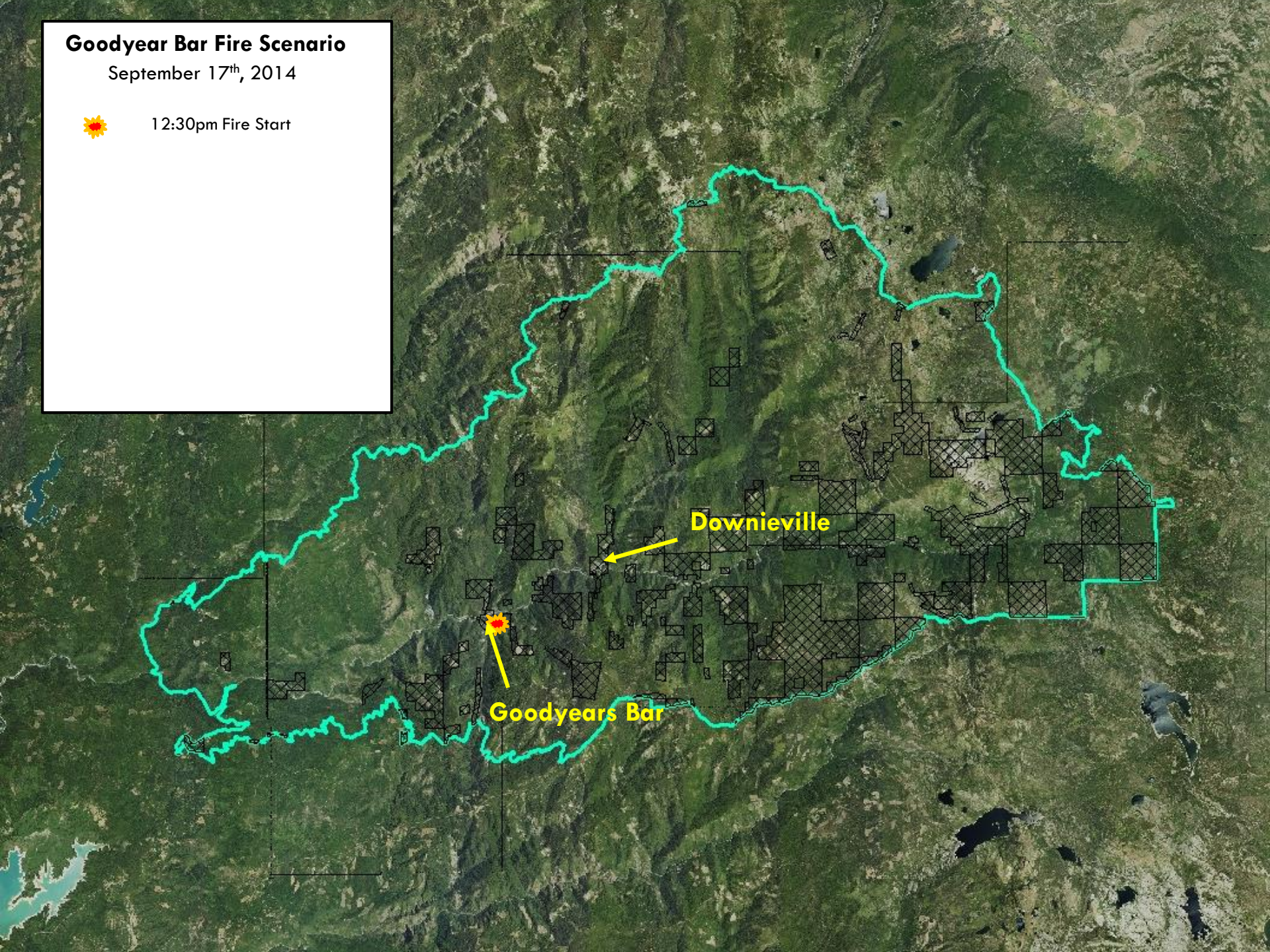
- Developed in response to current fire models inability to predict large or mega fire growth
- CAWFE combines a numerical weather prediction model and a fire behavior model that simulates the growth of a wildfire in response to weather, fuel conditions, and terrain
- These models are two-way coupled to constantly exchange information that creates a positive feed back loop of weather influencing fire behavior and then the fire influencing weather – winds, humidity
- Models smoke amounts and dispersion
- Both behavior and smoke outputs can be improved by high resolution LiDAR informed fuels data

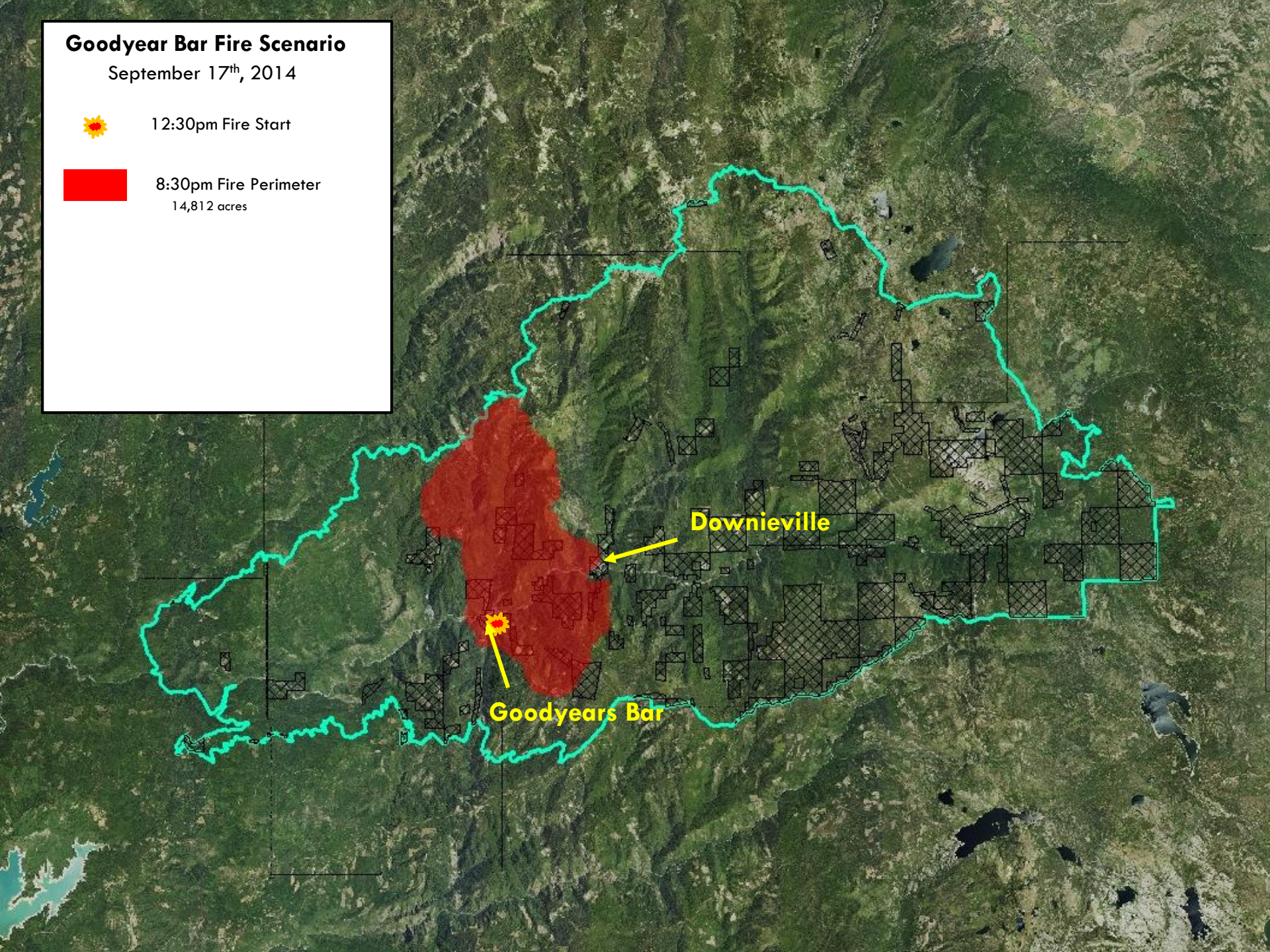


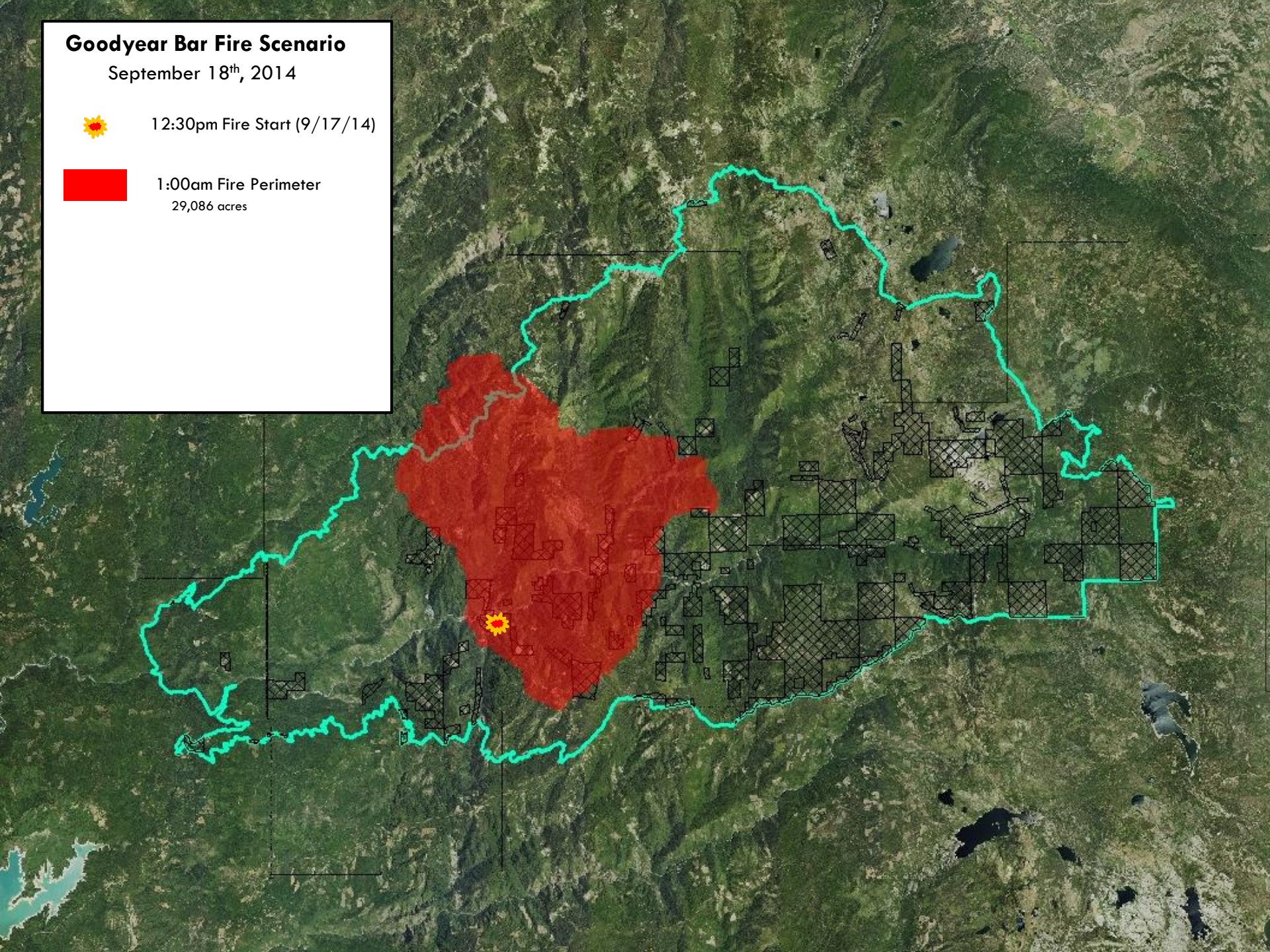
USDA Forest Service R5 Remote Sensing Lab

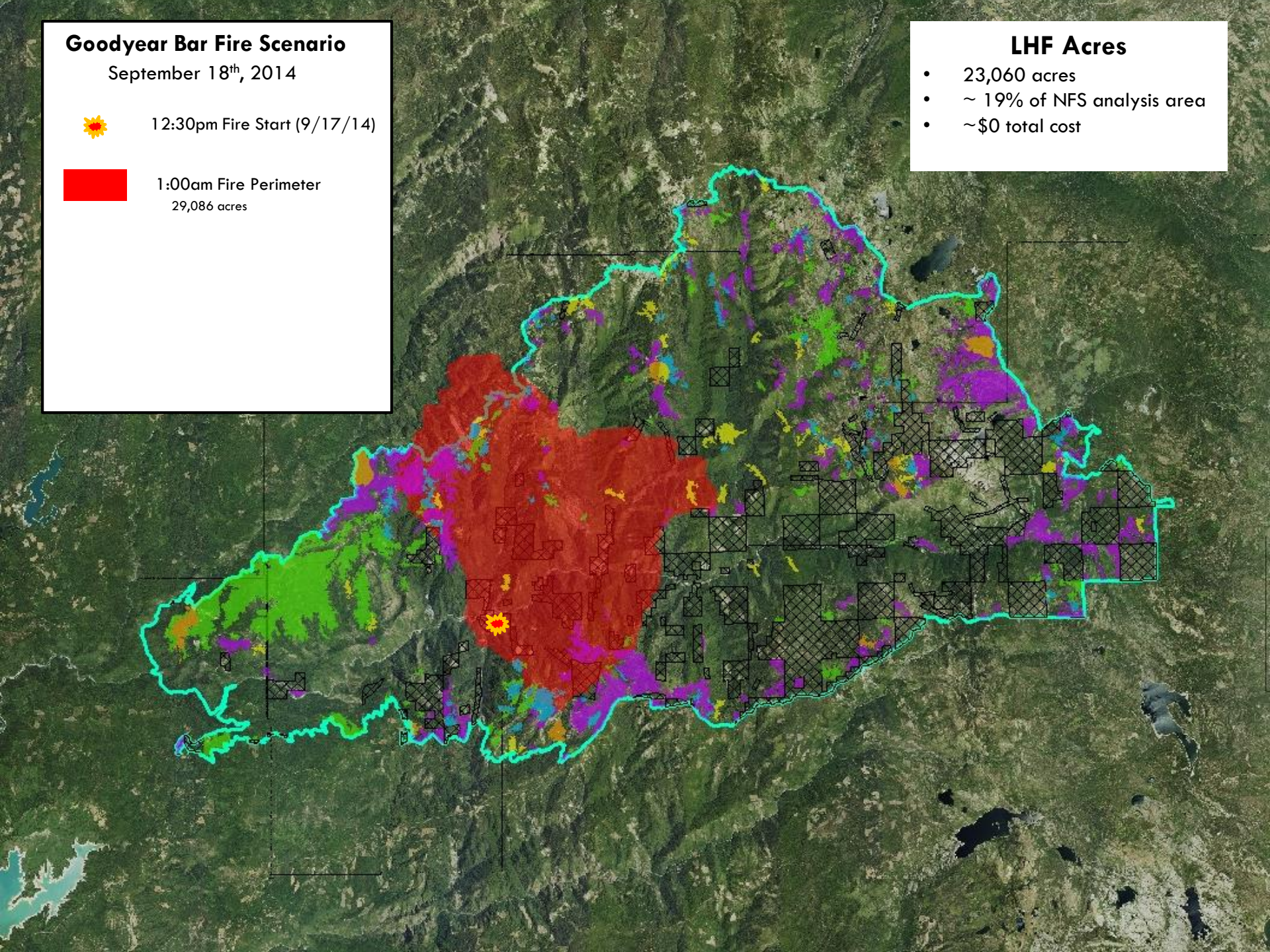
Credits:
Janice Coen – National Center for Atmospheric Research
Natasha Stavoros – NASA's Jet Propulsion Lab
Josephine Fite-Kaufman – USFS Region 5 Planning Team


Goodyear Bar Fire Scenario
September 17th, 2014
Downieville
Goodyears Bar

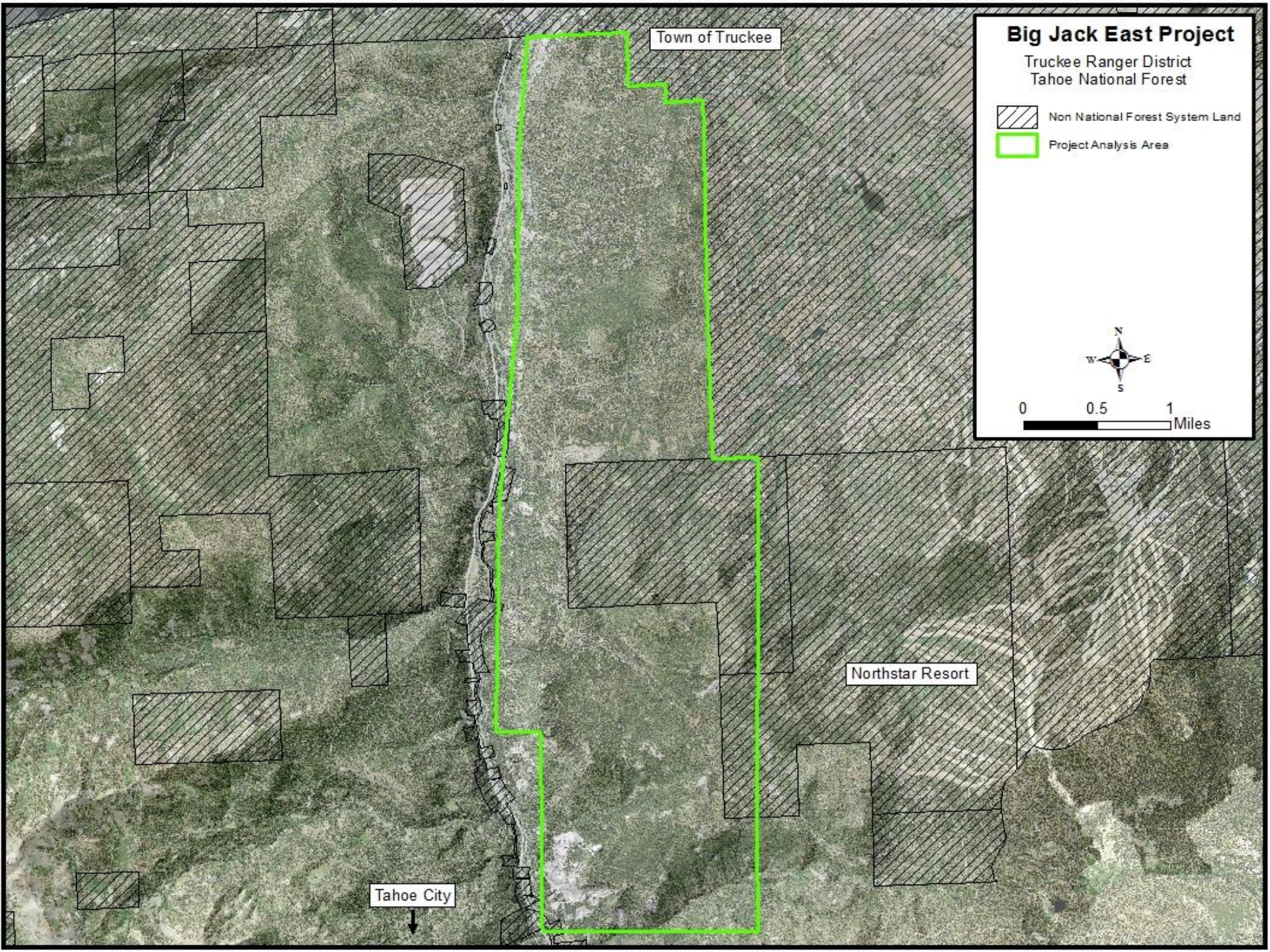

Goodyear Bar Fire Scenario
September 17th, 2014
12:30pm Fire Start
Downieville
Goodyears Bar

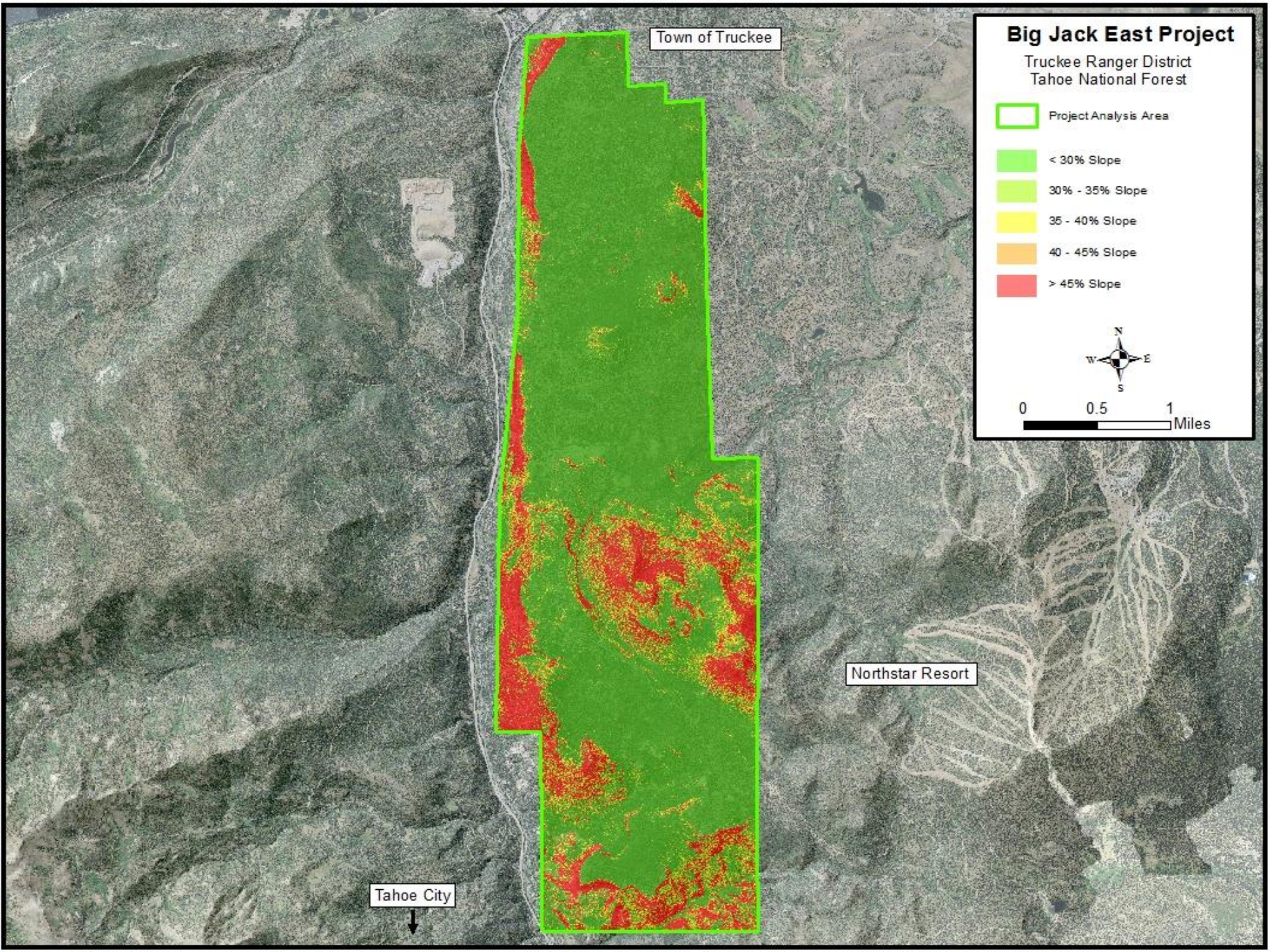

Goodyear Bar Fire Scenario
September 17th, 2014
12:30pm Fire Start
8:30pm Fire Perimeter
14,812 acres
Downieville
Goodyears Bar

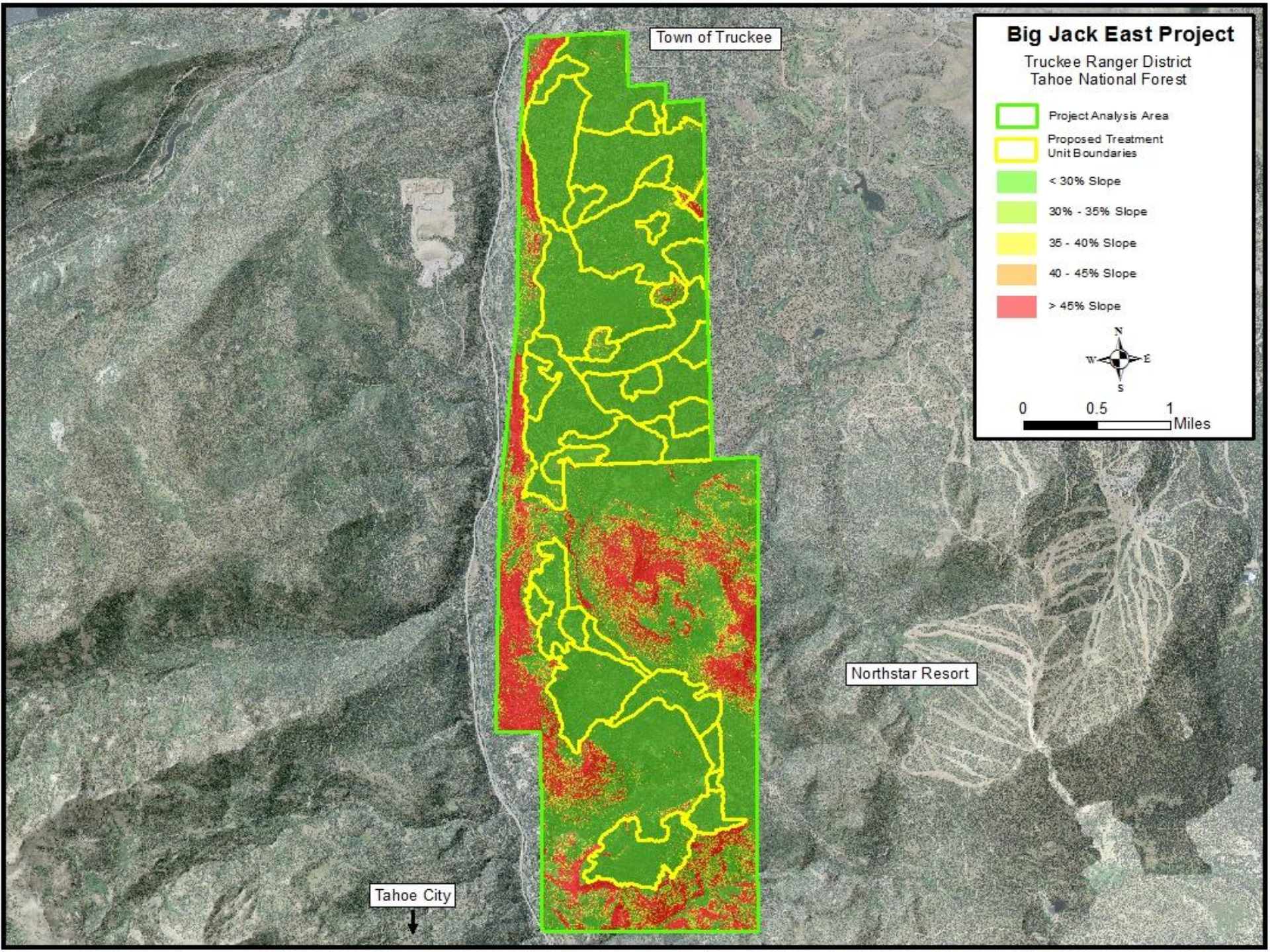

Goodyear Bar Fire Scenario
September 18th, 2014
12:30pm Fire Start (9/17/14)
1:00am Fire Perimeter
29,086 acres

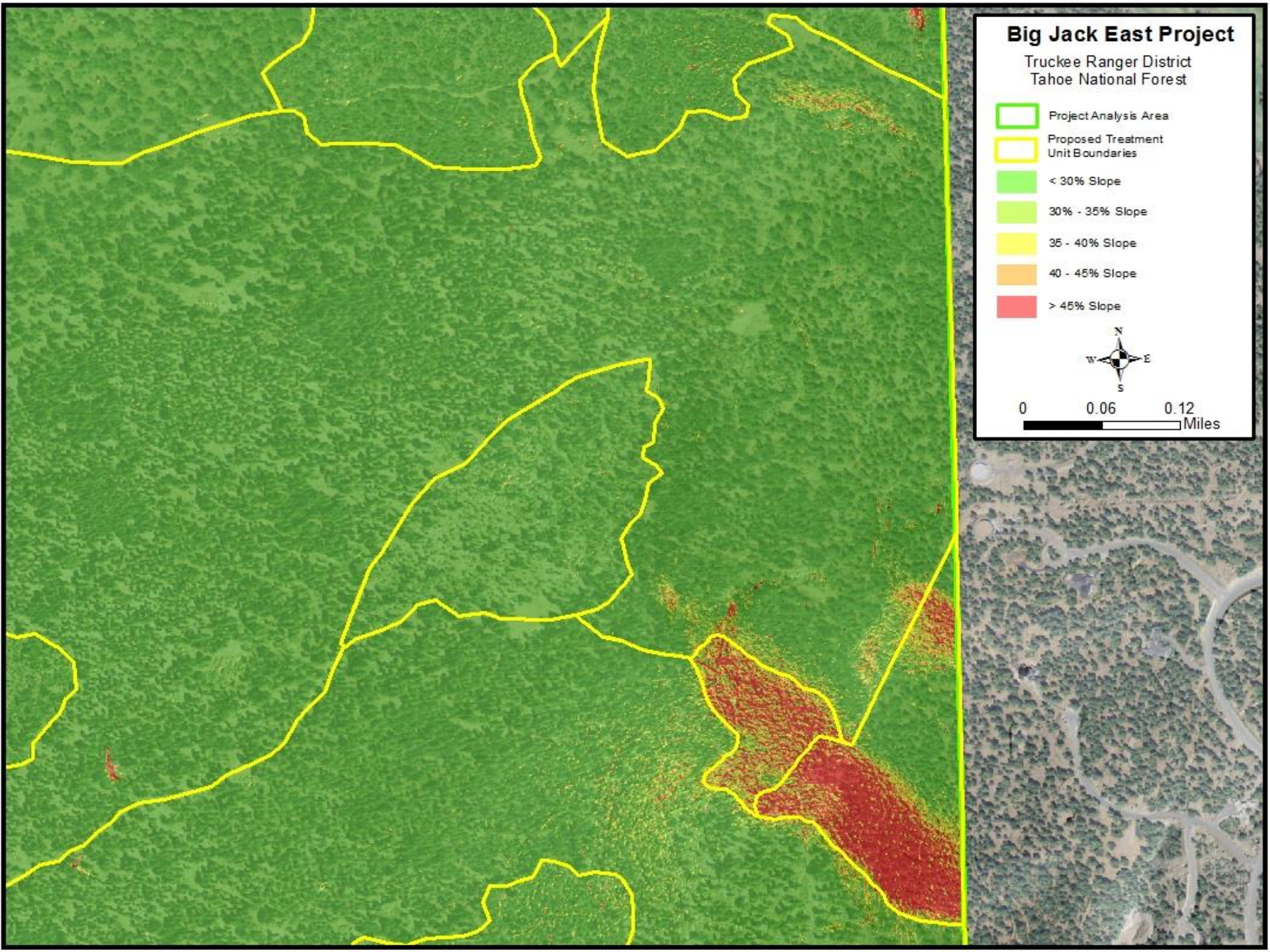

Goodyear Bar Fire Scenario
September 18th, 2014
12:30pm Fire Start (9/17/14)
1:00am Fire Perimeter
29,086 acres
LHF Acres
• 23,060 acres
• ~ 19% of NFS analysis area
• ~$0 total cost

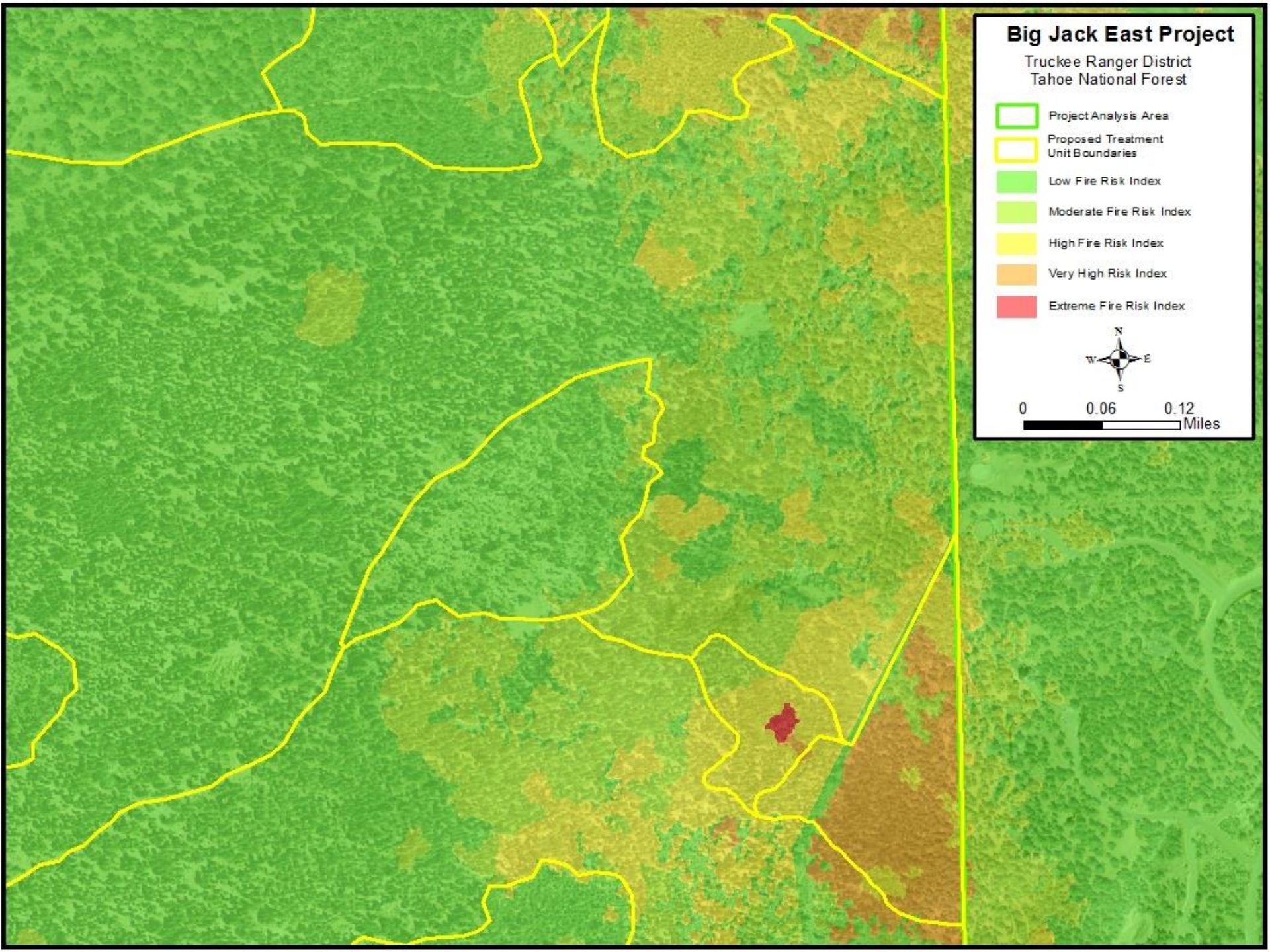
LIDAR AIDED PROJECT LAYOUT

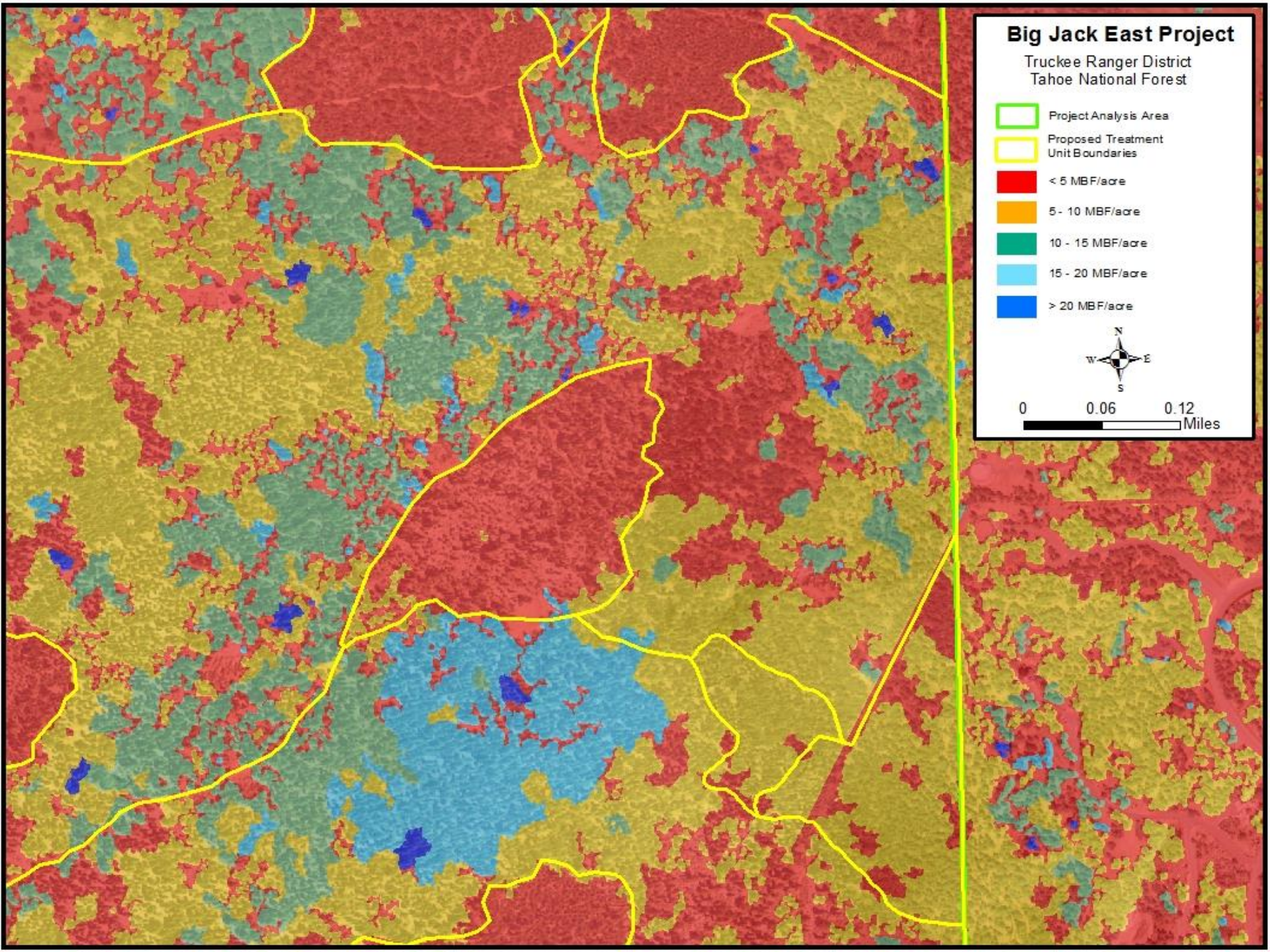

Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Non National Forest System Land
Project Analysis Area
N
W
E
S
0
0.5
1
Miles
Town of Truckee
Northstar Resort
Tahoe City

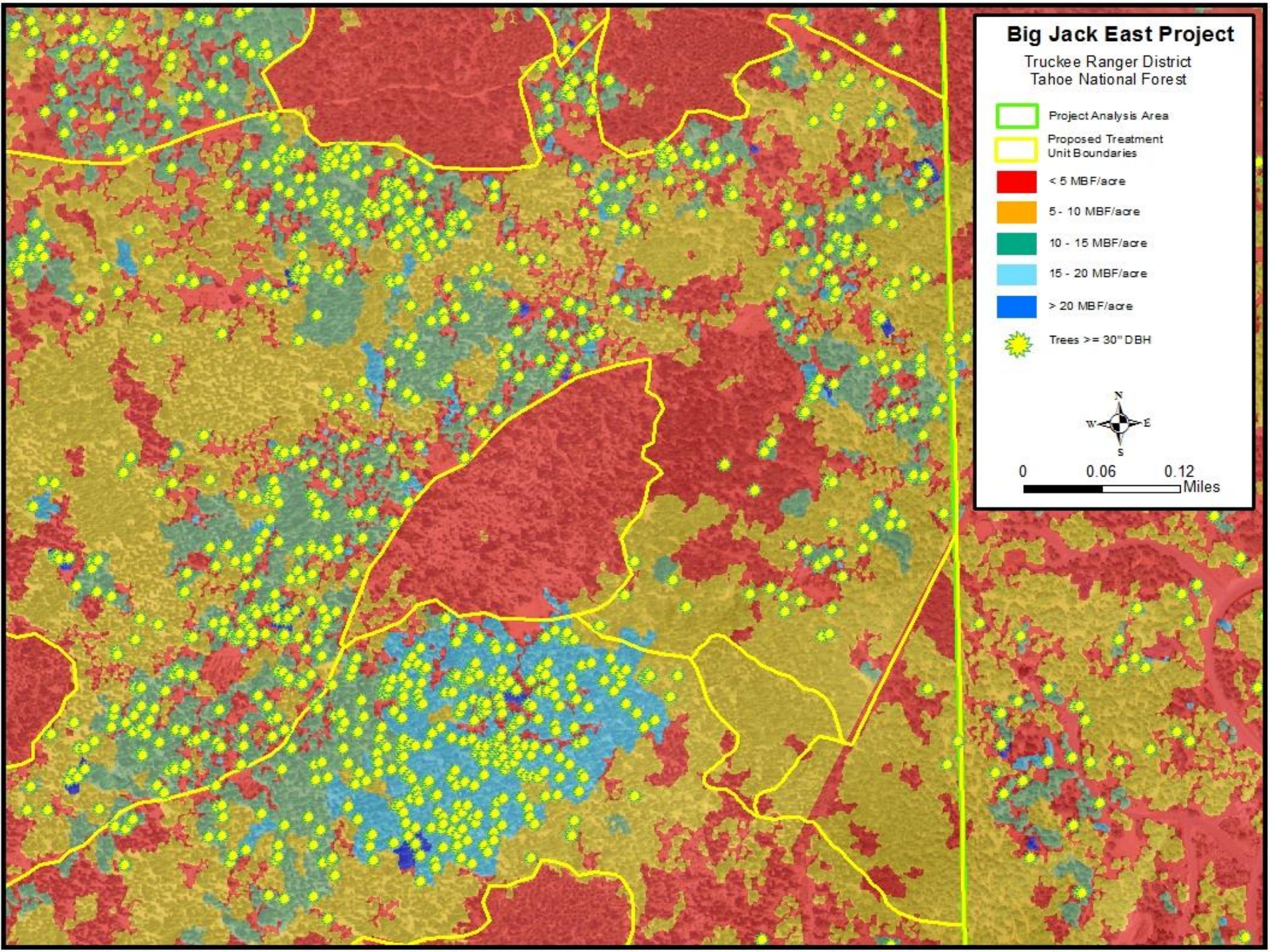

Town of Truckee
Northstar Resort
Tahoe City
Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
< 30% Slope
30% - 35% Slope
35 - 40% Slope
40 - 45% Slope
> 45% Slope
N
W
E
S
0
0.5
1
Miles


Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment Unit Boundaries
< 30% Slope
30% - 35% Slope
35 - 40% Slope
40 - 45% Slope
> 45% Slope
N
W
E
S
0
0.5
1
Miles
Town of Truckee
Northstar Resort
Tahoe City


Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment Unit Boundaries
< 30% Slope
30% - 35% Slope
35 - 40% Slope
40 - 45% Slope
> 45% Slope
N
W
E
S
0
0.06
0.12
Miles

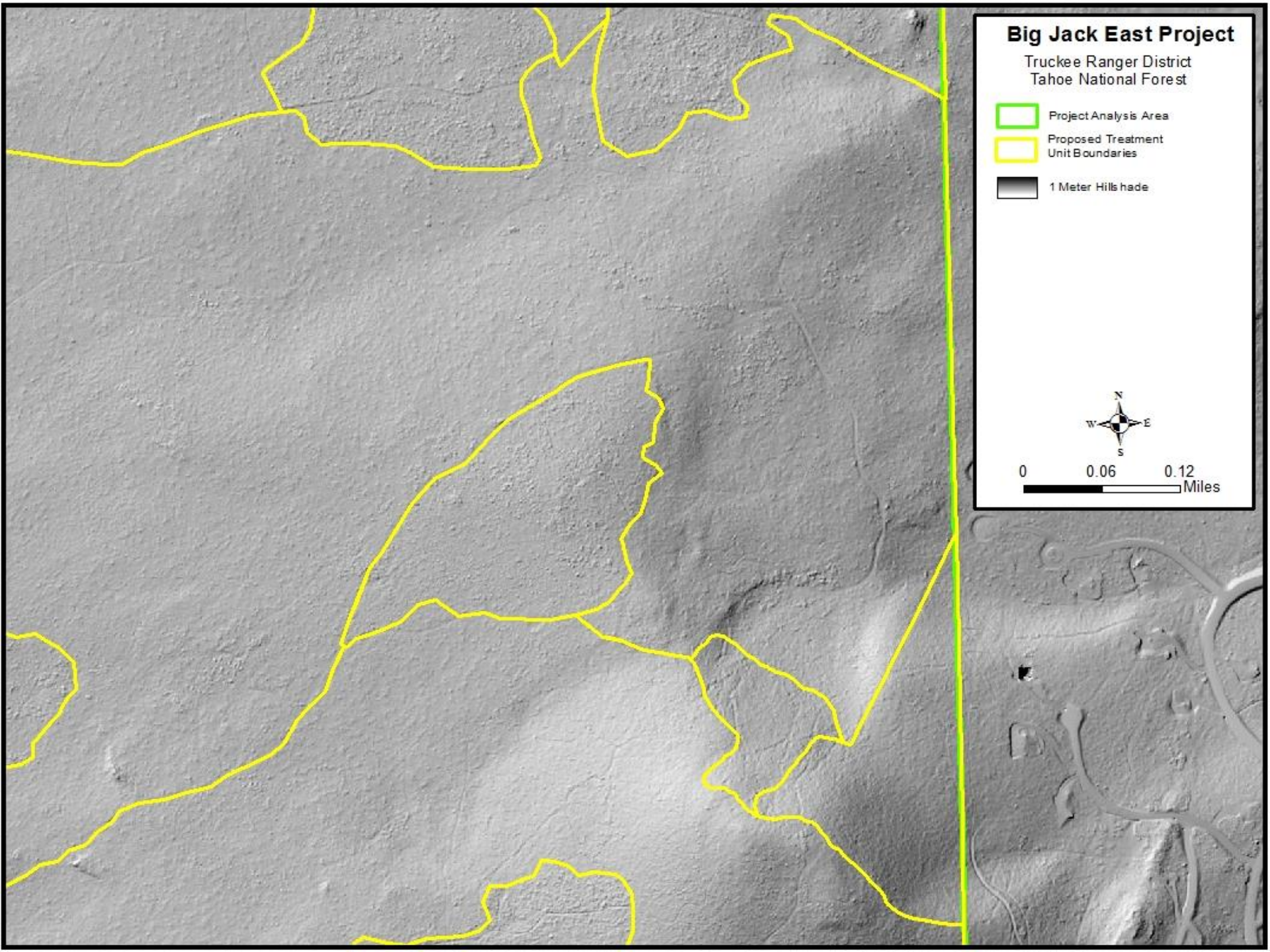

Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment Unit Boundaries
Low Fire Risk Index
Moderate Fire Risk Index
High Fire Risk Index
Very High Risk Index
Extreme Fire Risk Index
N
W
E
S
0
0.06
0.12
Miles

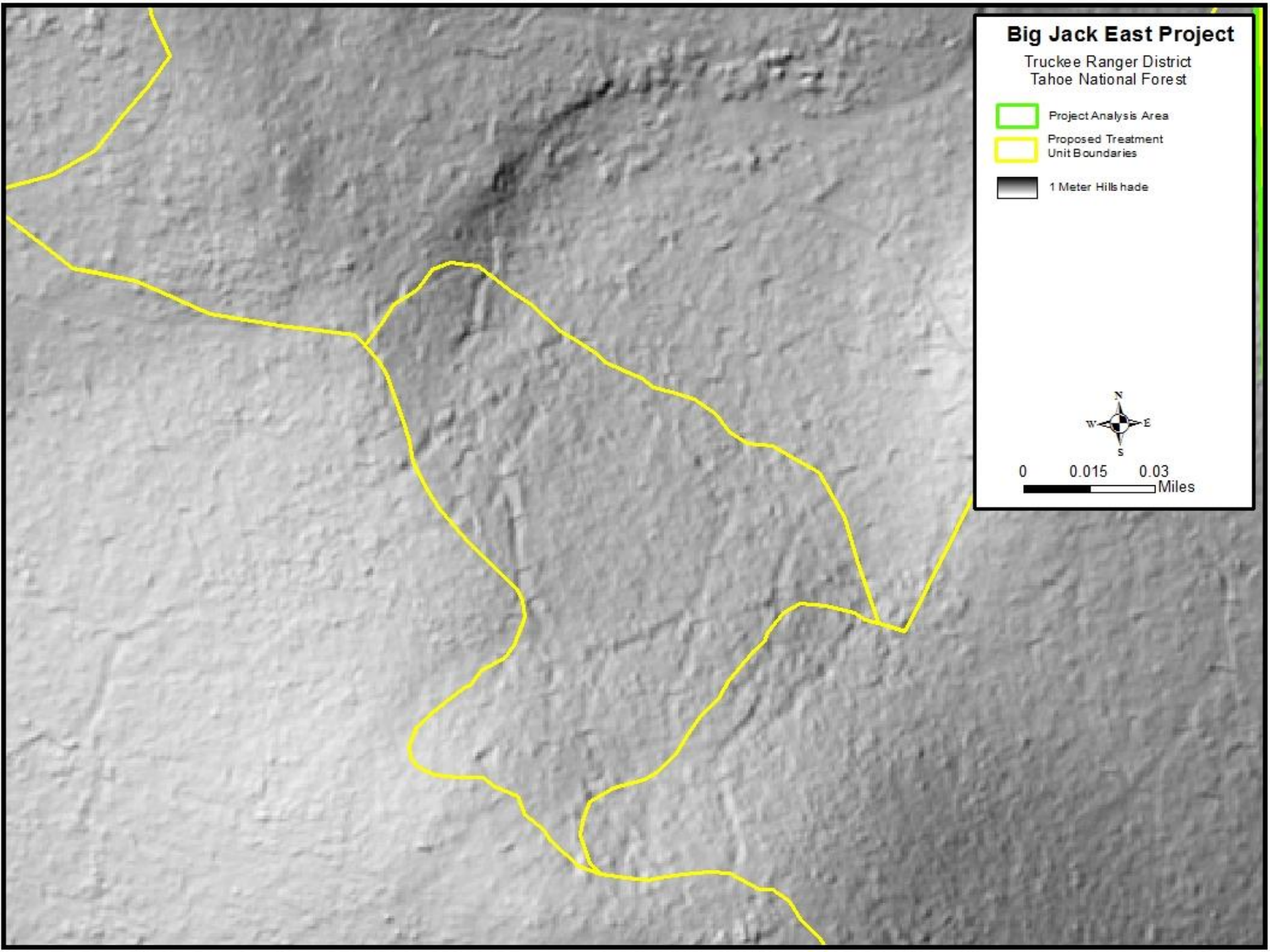

Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment Unit Boundaries
< 5 MBF/acre
5 - 10 MBF/acre
10 - 15 MBF/acre
15 - 20 MBF/acre
> 20 MBF/acre
N
W
E
S
0
0.06
0.12
Miles

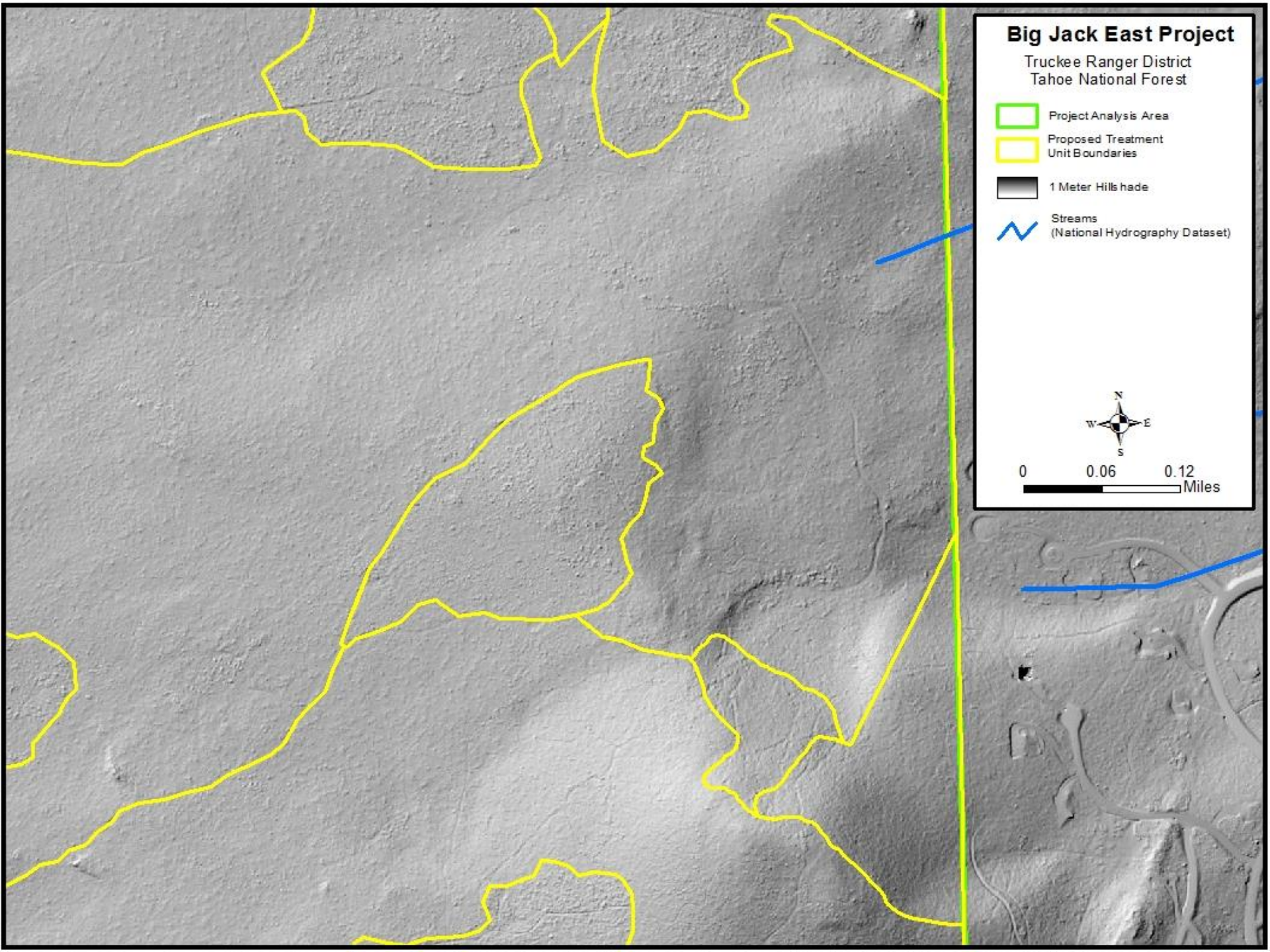

Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment Unit Boundaries
< 5 MBF/acre
5 - 10 MBF/acre
10 - 15 MBF/acre
15 - 20 MBF/acre
> 20 MBF/acre
Trees >= 30" DBH
N
W
E
S
0
0.06
0.12
Miles

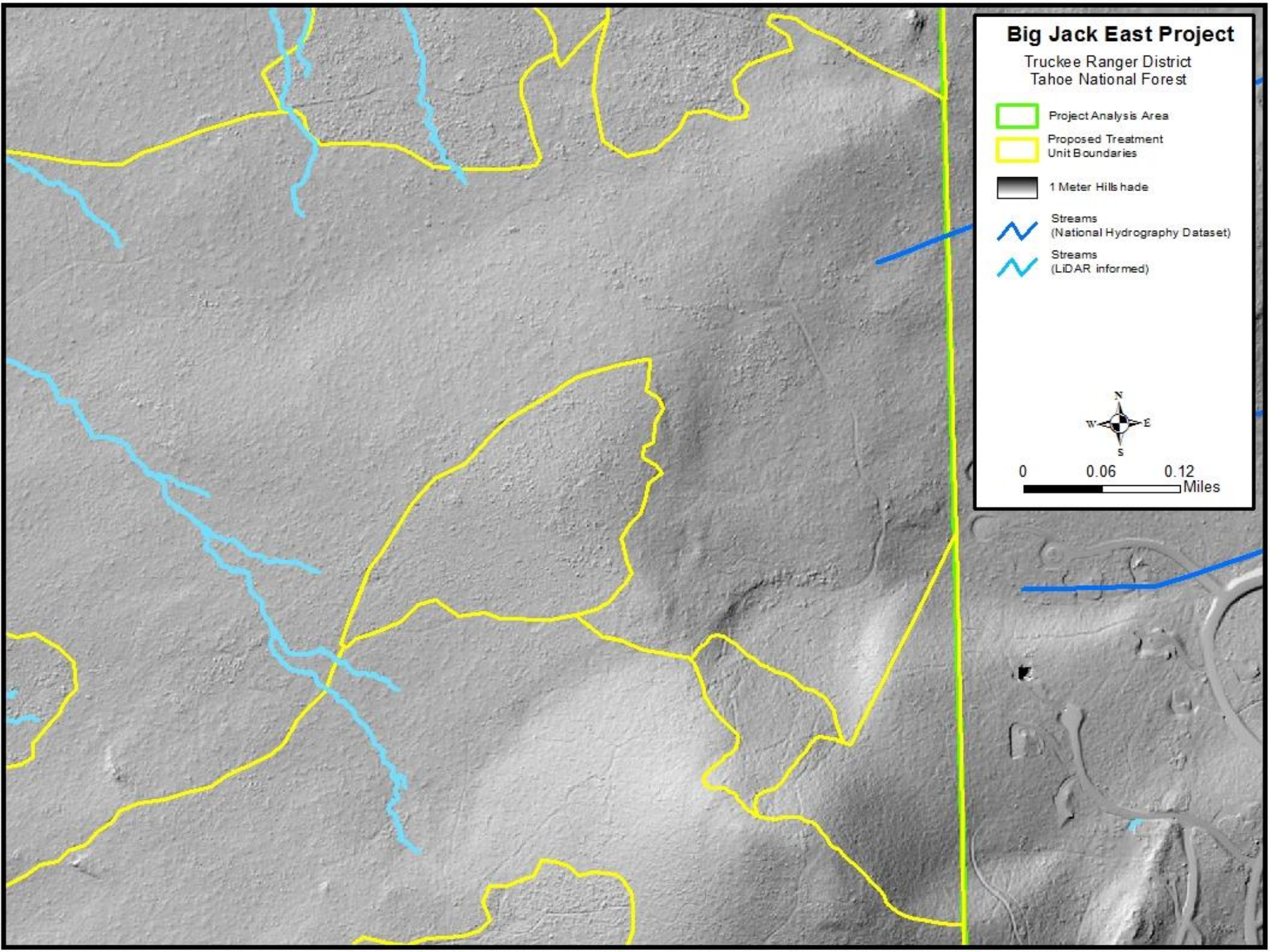
LIDAR AIDED PROJECT SURVEYS

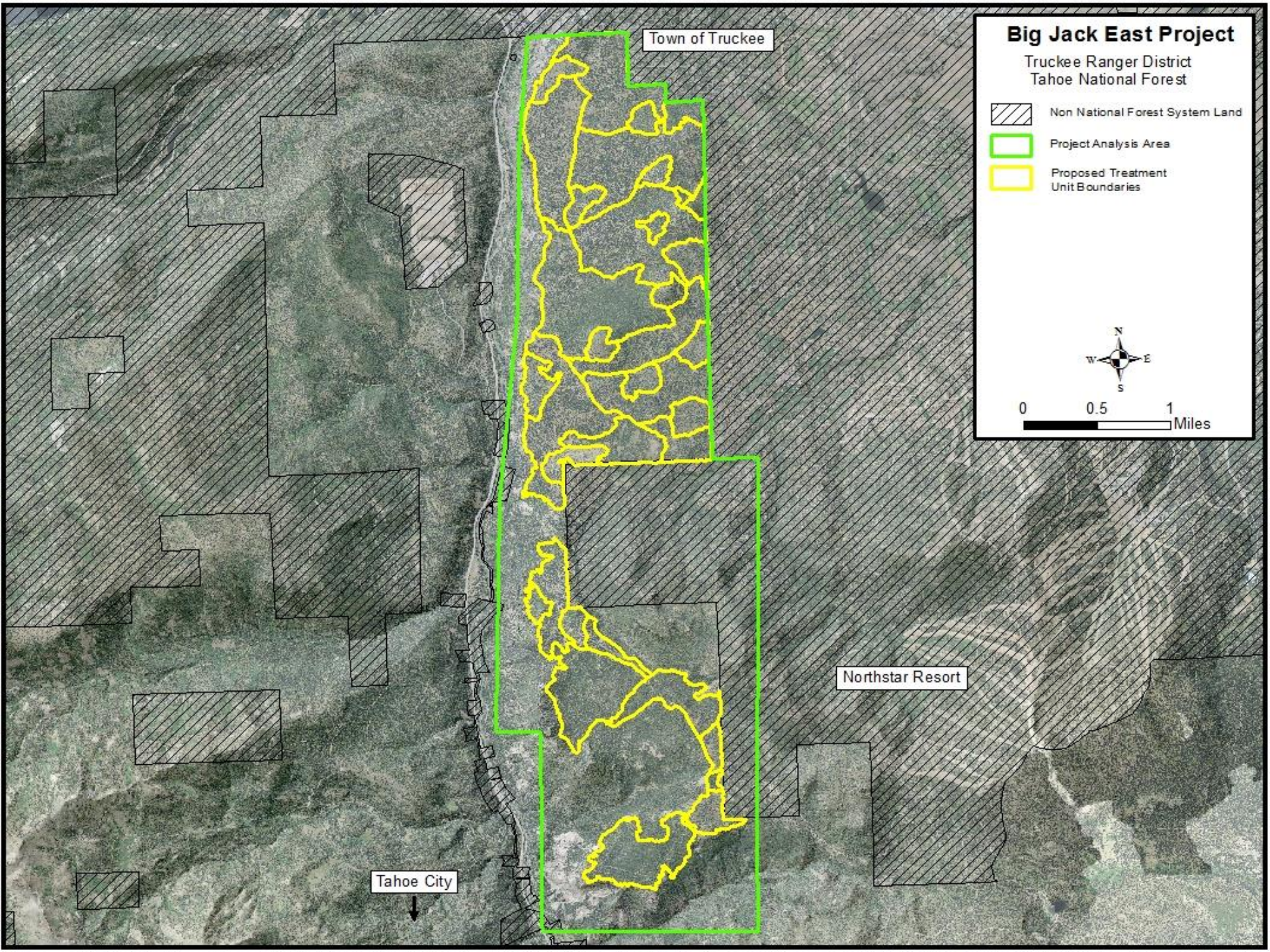
Credits:
Mike Cartmill – USFS Truckee Ranger District
John Brokaw – USFS Truckee Ranger District

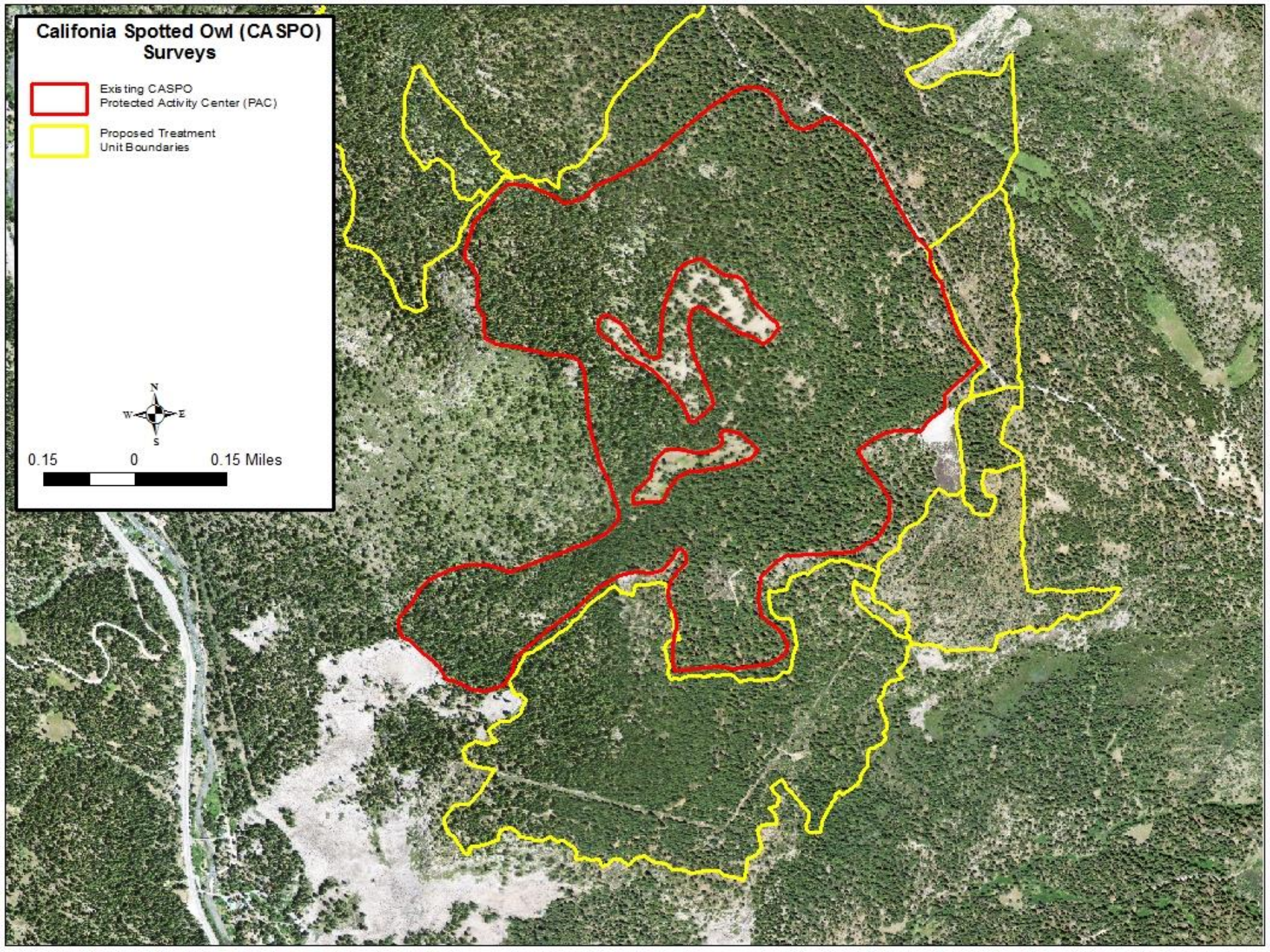

Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment Unit Boundaries
1 Meter Hillshade
N
W
E
S
0
0.06
0.12
Miles

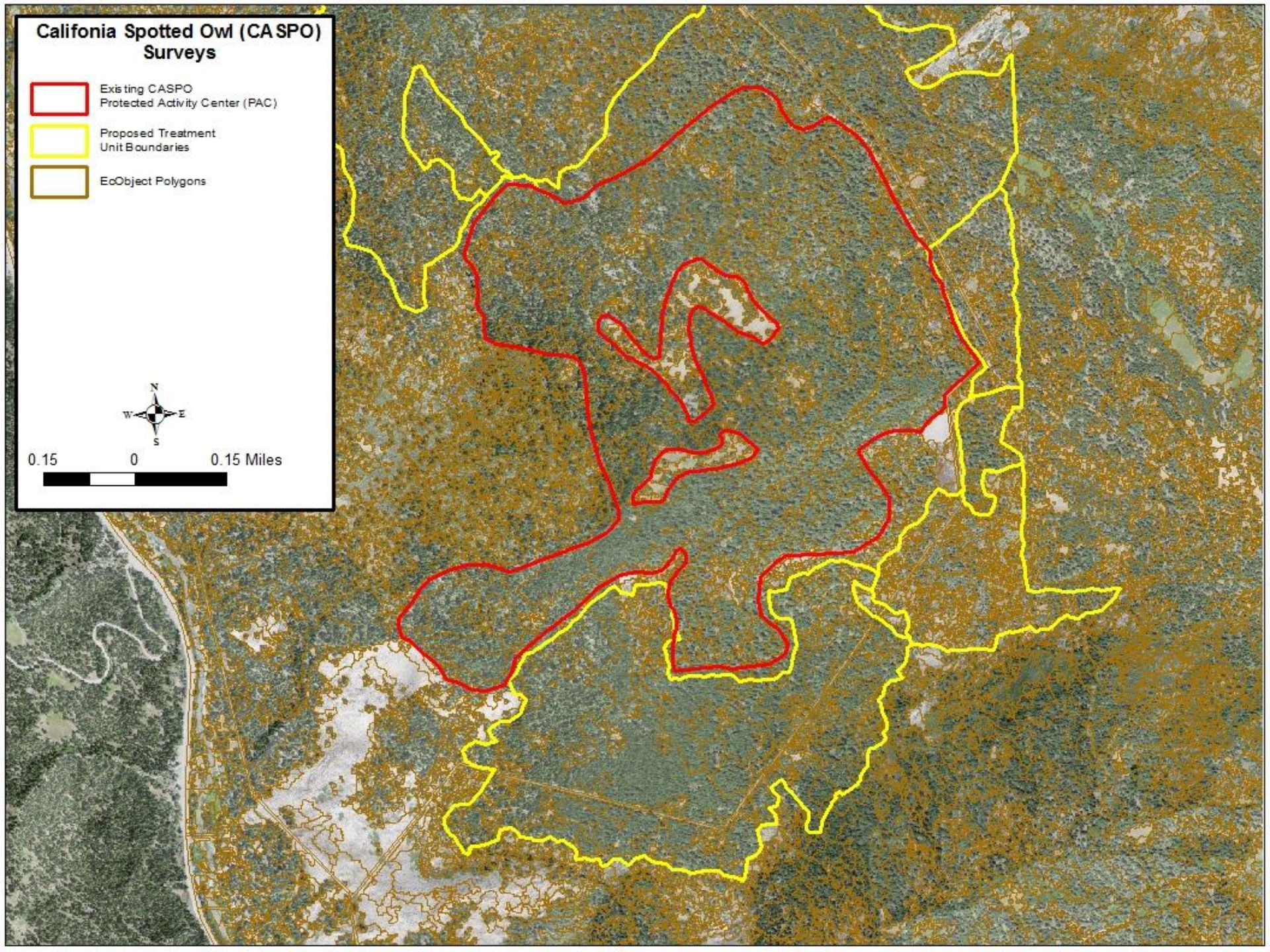

Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment Unit Boundaries
1 Meter Hillshade
N
W
E
S
0
0.015
0.03
Miles

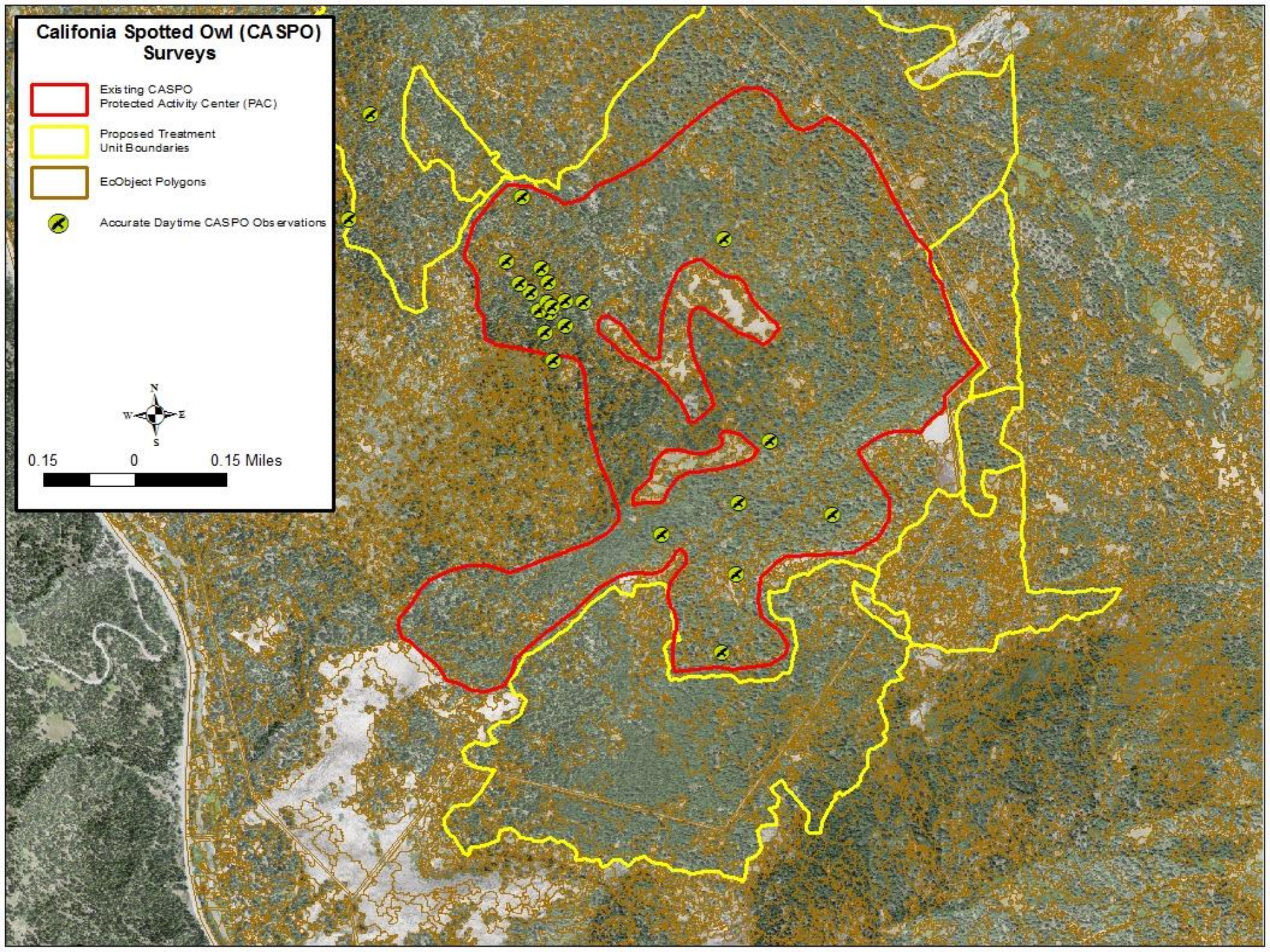

Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment
Unit Boundaries
1 Meter Hillshade
Streams
(National Hydrography Dataset)
N
W
E
S
0
0.06
0.12
Miles

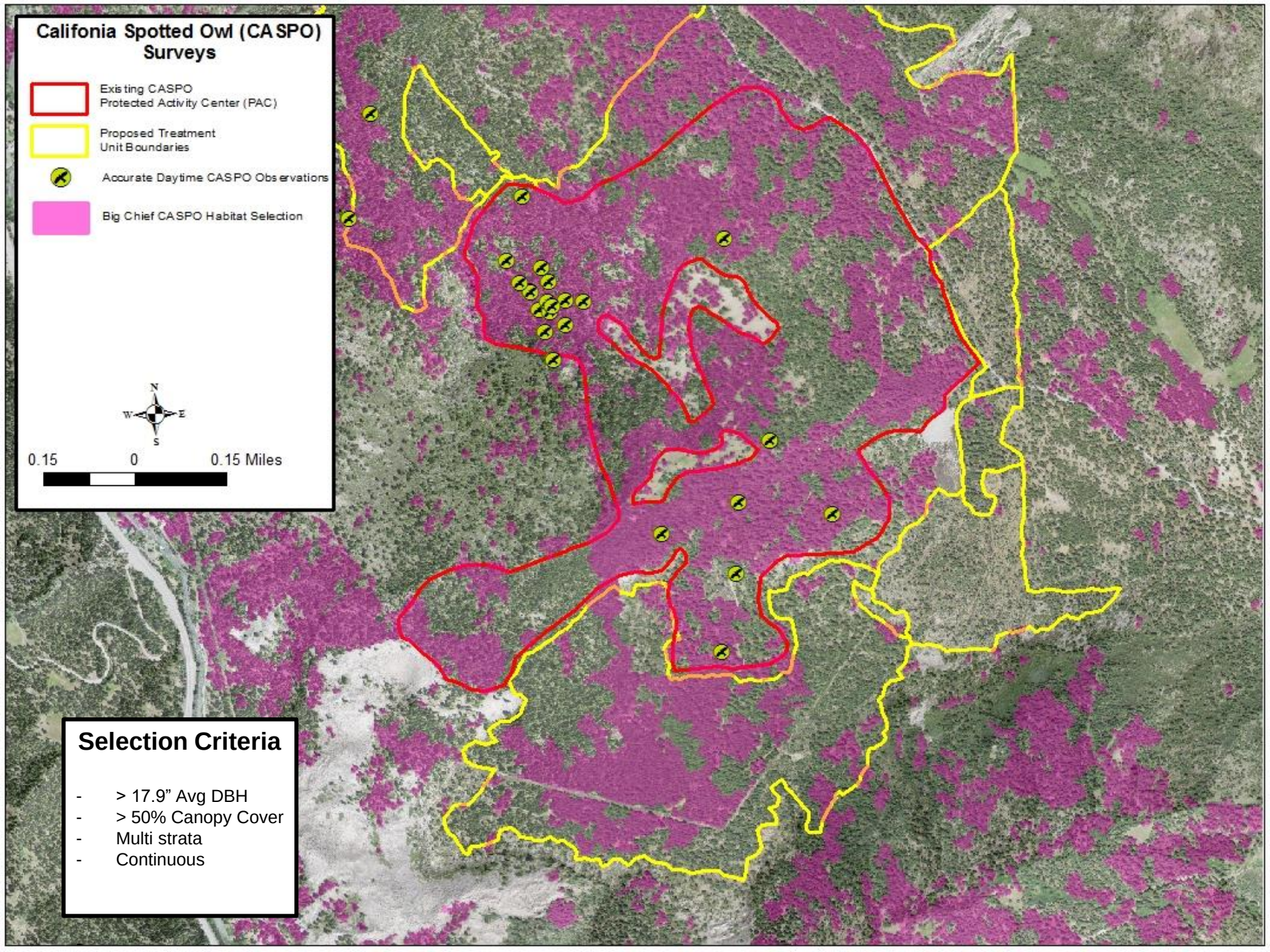

Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment Unit Boundaries
1 Meter Hillshade
Streams (National Hydrography Dataset)
Streams (LiDAR informed)
N
W
E
S
0
0.06
0.12
Miles

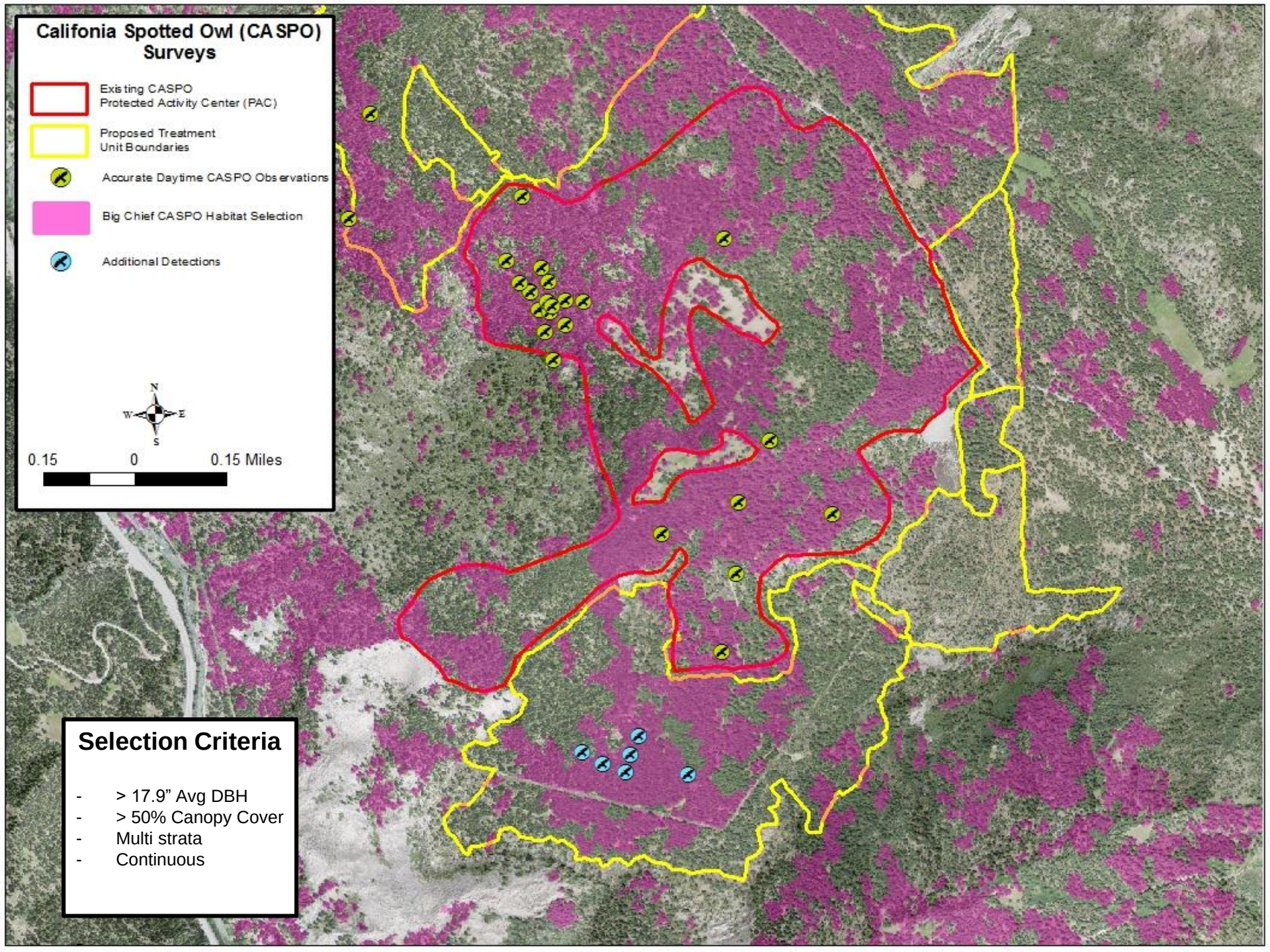

Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Non National Forest System Land
Project Analysis Area
Proposed Treatment Unit Boundaries
N
W
E
S
0
0.5
1
Miles
Town of Truckee
Northstar Resort
Tahoe City


Califonia Spotted Owl (CASPO) Surveys
Existing CASPO Protected Activity Center (PAC)
Proposed Treatment Unit Boundaries
N
W
E
S
0.15
0
0.15 Miles


Califonia Spotted Owl (CASPO) Surveys
Existing CASPO Protected Activity Center (PAC)
Proposed Treatment Unit Boundaries
EcObject Polygons
N
W
E
S
0.15
0
0.15 Miles

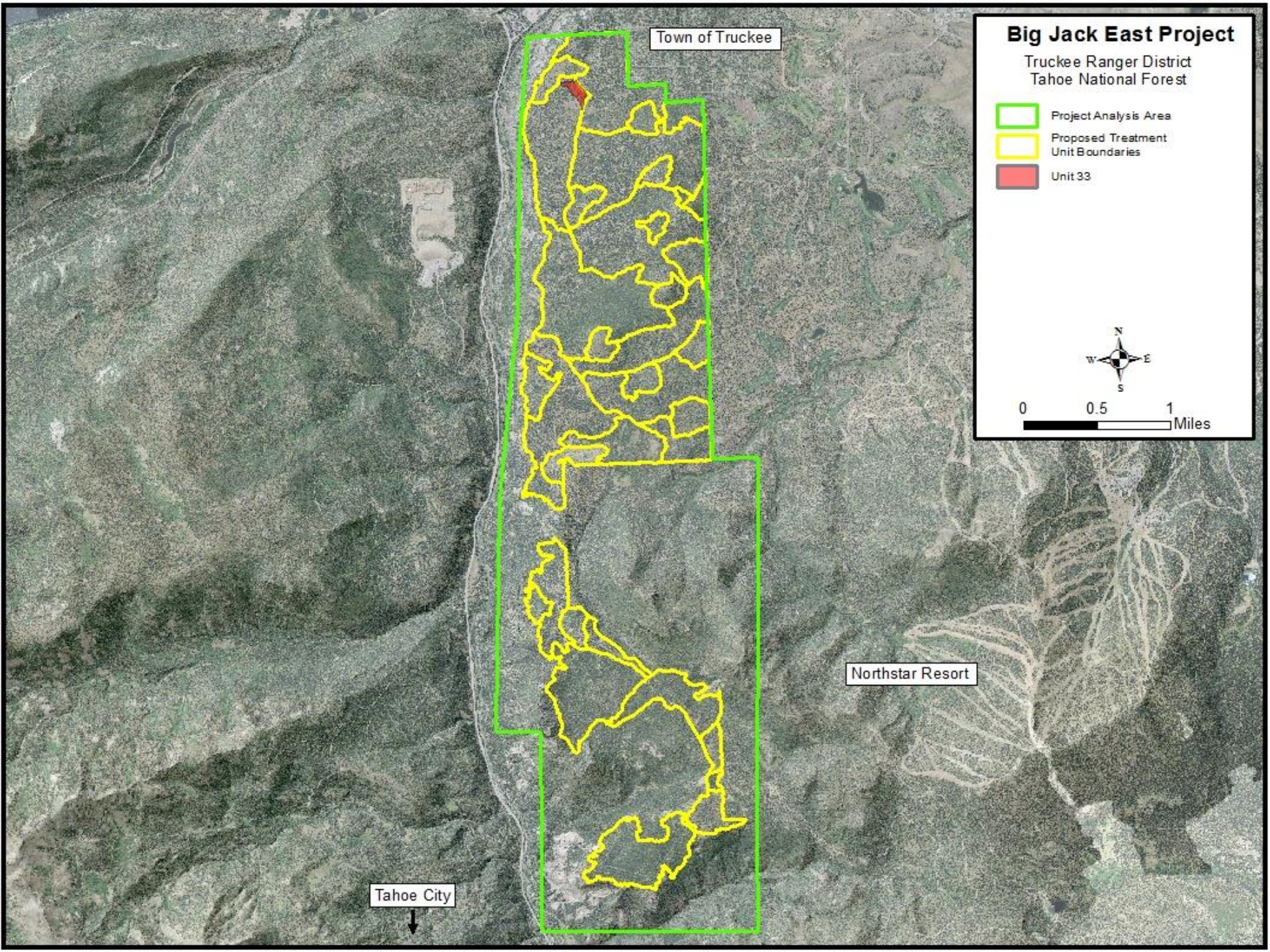

California Spotted Owl (CASPO) Surveys
Existing CASPO Protected Activity Center (PAC)
Proposed Treatment Unit Boundaries
EcObject Polygons
Accurate Daytime CASPO Observations
N
W
E
S
0.15
0
0.15 Miles

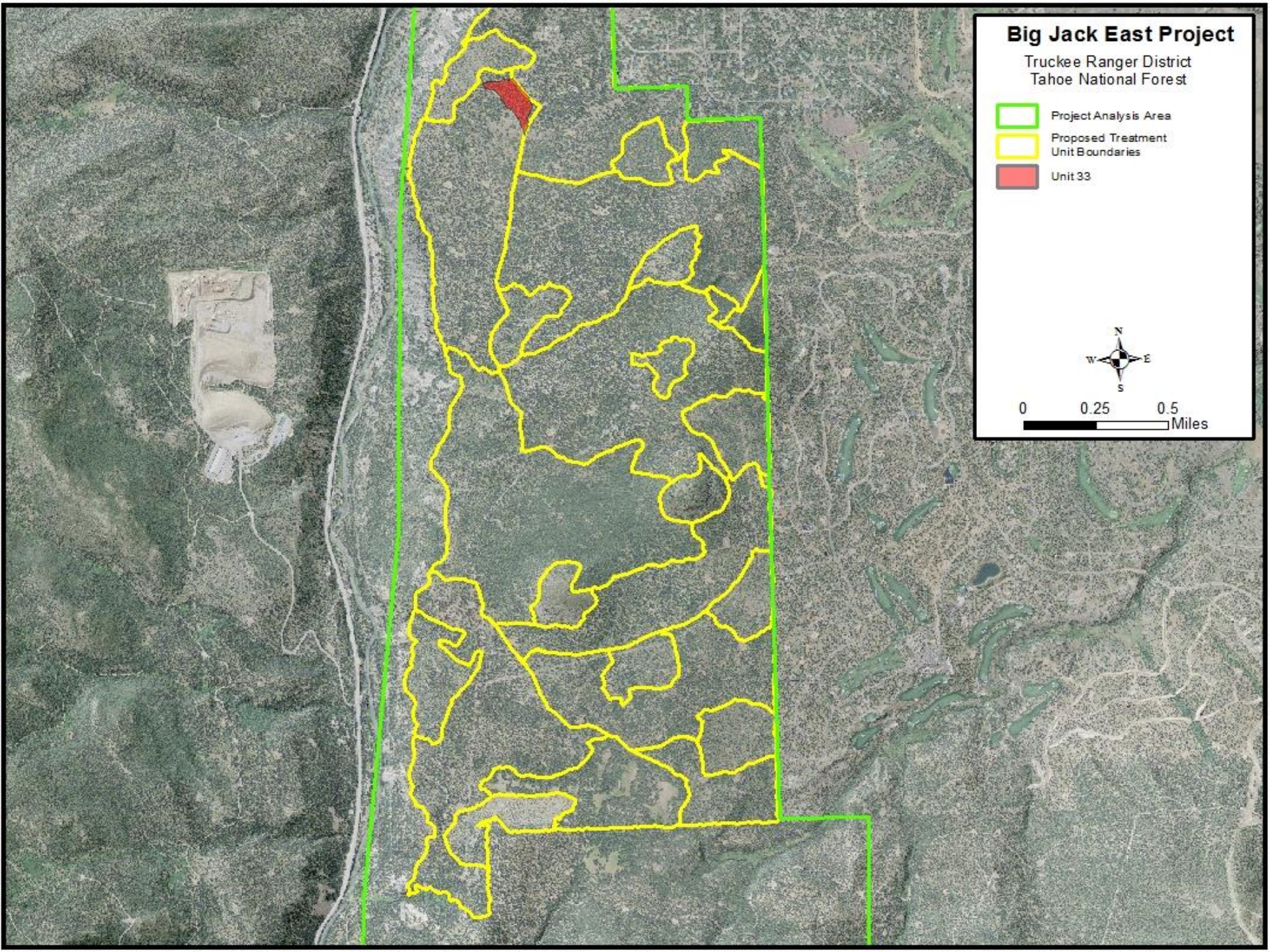

Califonia Spotted Owl (CASPO) Surveys
Existing CASPO Protected Activity Center (PAC)
Proposed Treatment Unit Boundaries
Accurate Daytime CASPO Observations
Big Chief CASPO Habitat Selection
N
W
E
S
0.15
0
0.15 Miles
Selection Criteria
- > 17.9” Avg DBH
- > 50% Canopy Cover
- Multi strata
- Continuous

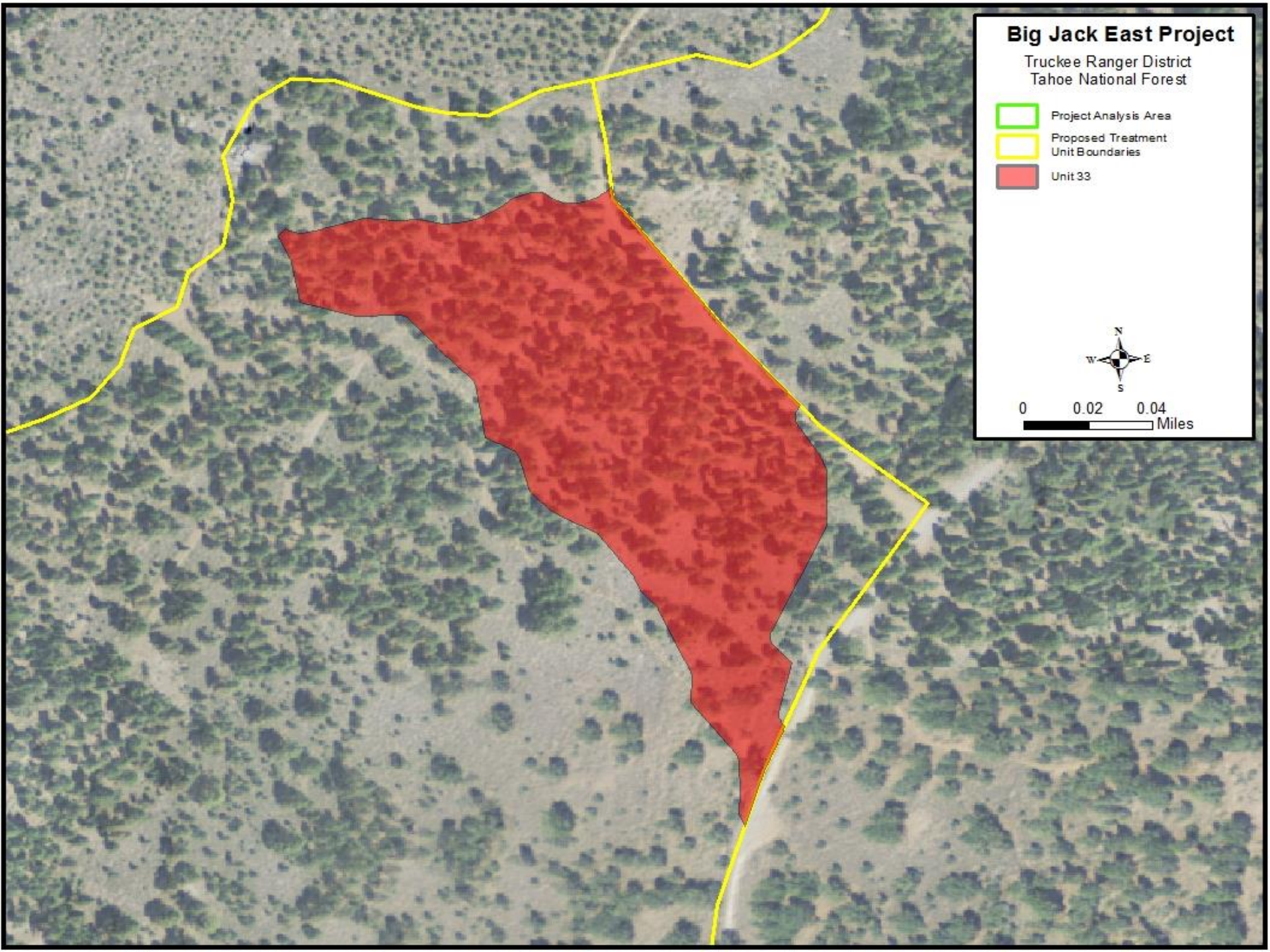

Califonia Spotted Owl (CASPO) Surveys
Existing CASPO Protected Activity Center (PAC)
Proposed Treatment Unit Boundaries
Accurate Daytime CASPO Observations
Big Chief CASPO Habitat Selection
Additional Detections
N
W
E
S
0.15
0
0.15 Miles
Selection Criteria
- > 17.9” Avg DBH
- > 50% Canopy Cover
- Multi strata
- Continuous

LIDAR AIDED RESTORATION TREATMENT ANALYSIS

Credits:
Mike Cartmill – USFS Truckee Ranger District
John Brokaw – USFS Truckee Ranger District


Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment Unit Boundaries
Unit 33
N
W
E
S
0
0.5
1
Miles
Town of Truckee
Northstar Resort
Tahoe City


Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment Unit Boundaries
Unit 33
N
W
E
S
0
0.25
0.5
Miles

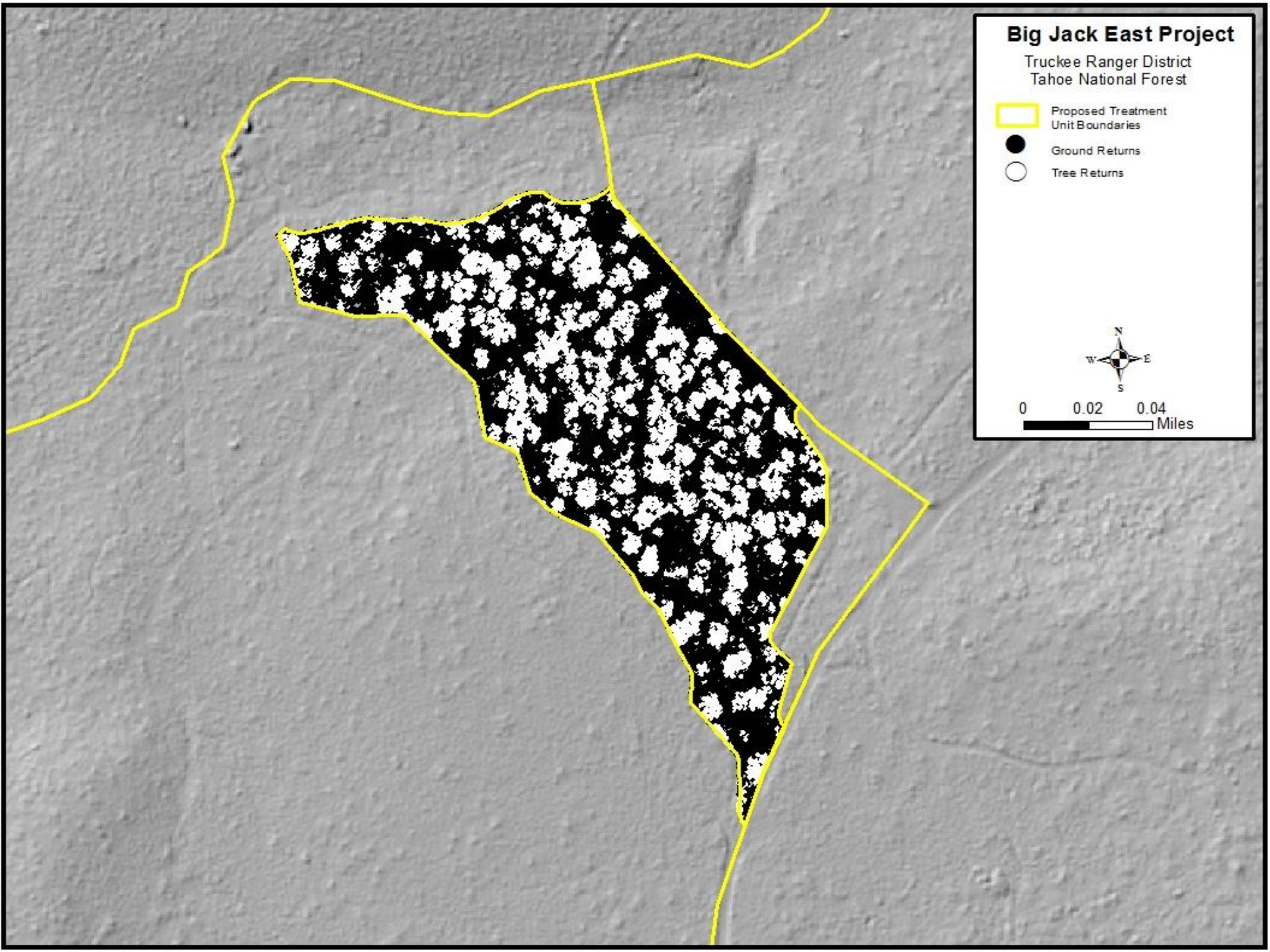

Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Project Analysis Area
Proposed Treatment Unit Boundaries
Unit 33
N
W
E
S
0
0.02
0.04
Miles

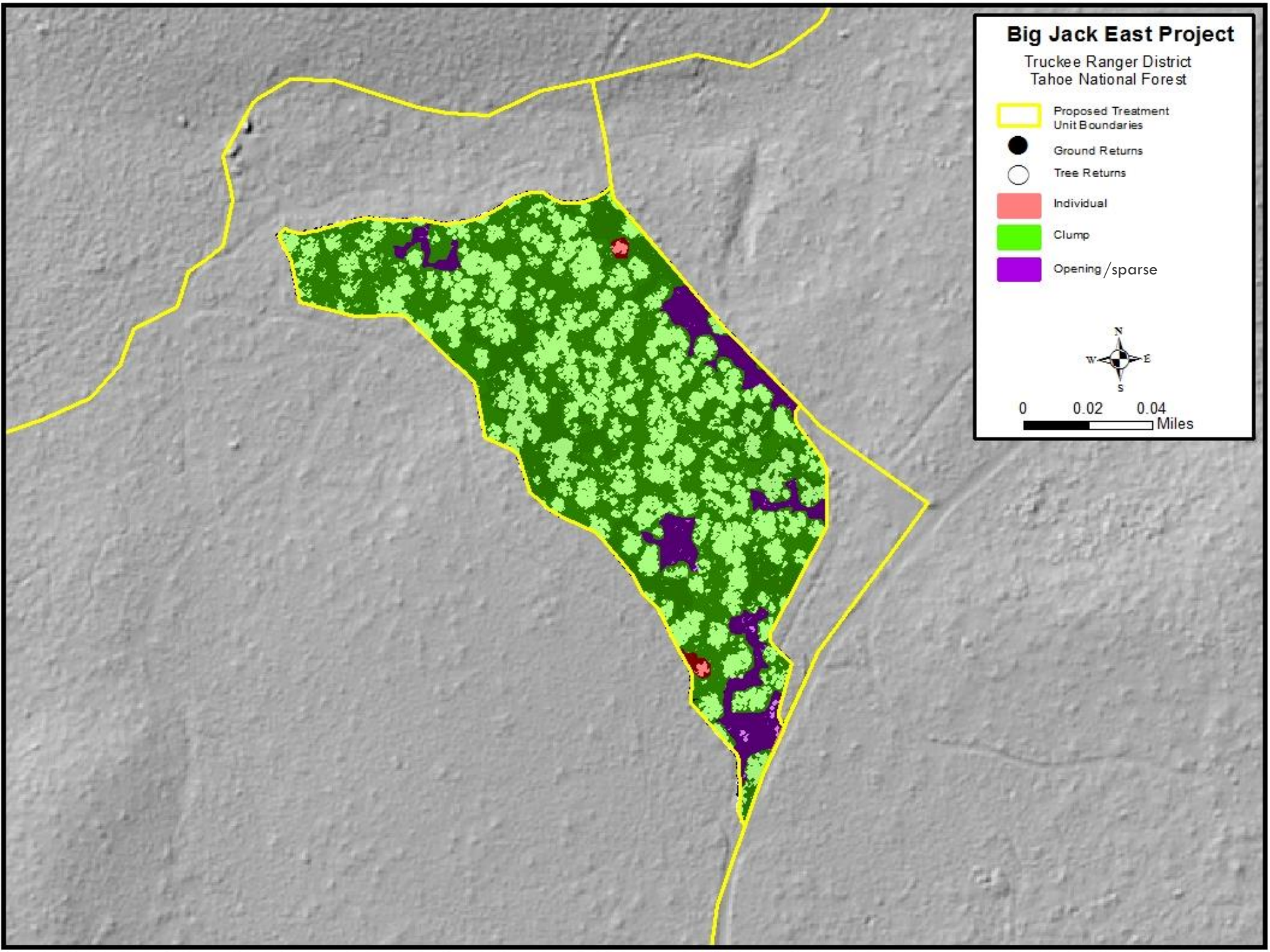
USDA Forest Service
R5 Remote Sensing Lab

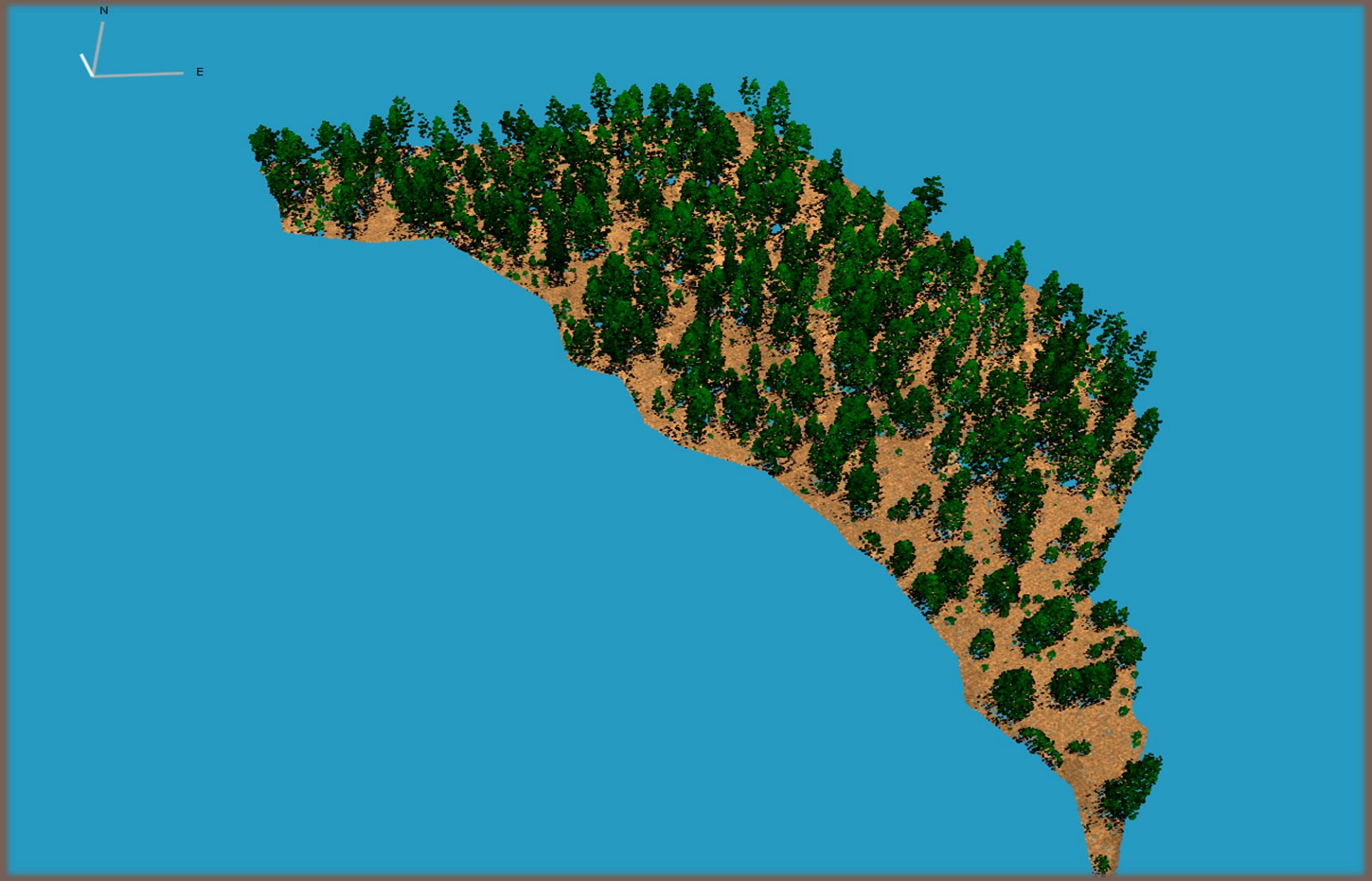
Credits:

Kirk Evans – USFS Remote Sensing Lab

Carlos Ramirez – USFS Remote Sensing Lab


Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Proposed Treatment Unit Boundaries
Ground Returns
Tree Returns
N
W
E
S
0
0.02
0.04
Miles


Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Proposed Treatment Unit Boundaries
Ground Returns
Tree Returns
Individual
Clump
Opening/sparse
N
W
E
S
0
0.02
0.04
Miles



Credits:

Kirk Evans – USFS Remote Sensing Lab

Carlos Ramirez – USFS Remote Sensing Lab

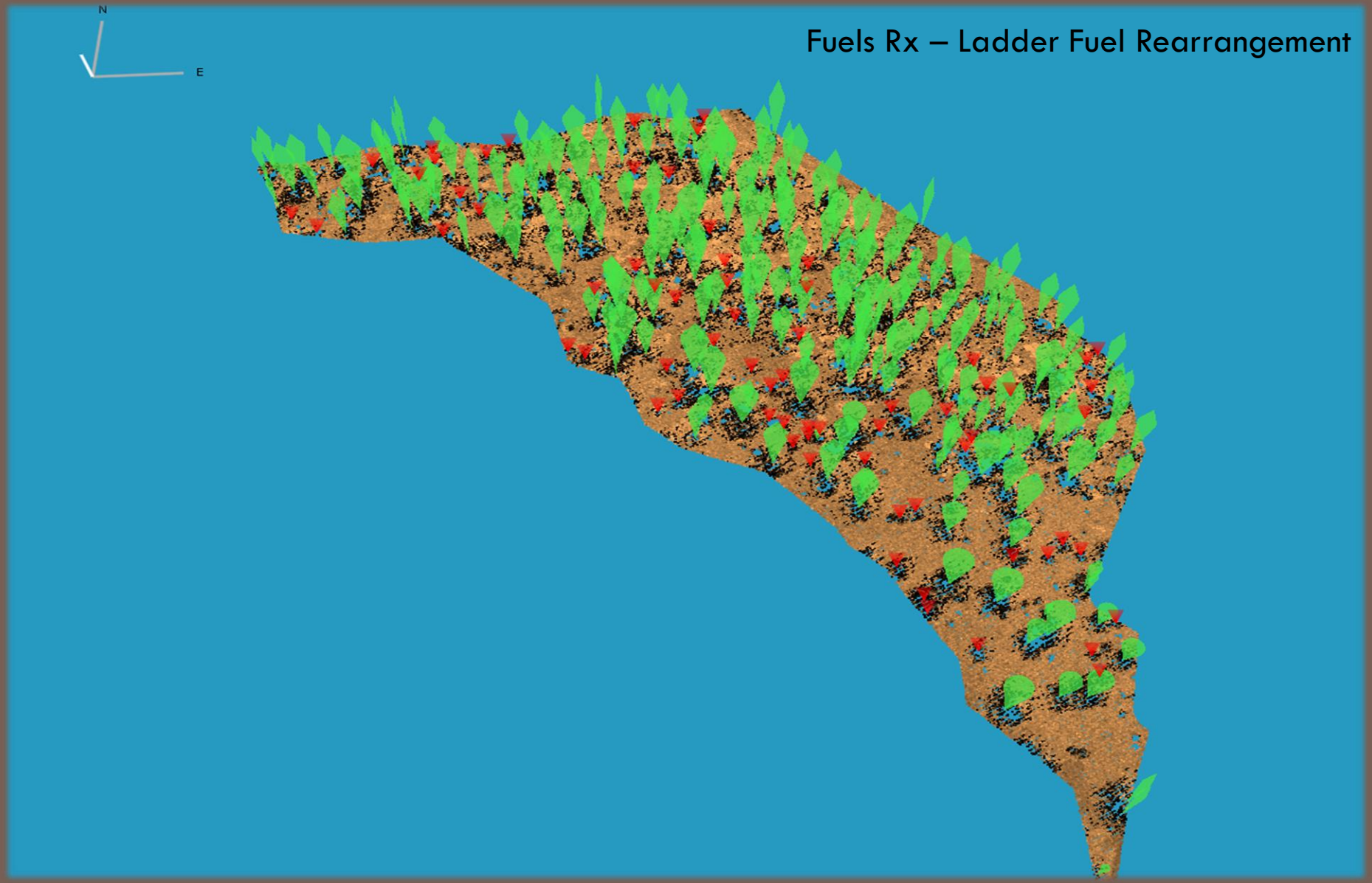
USDA Forest Service
R5 Remote Sensing Lab

Credits:

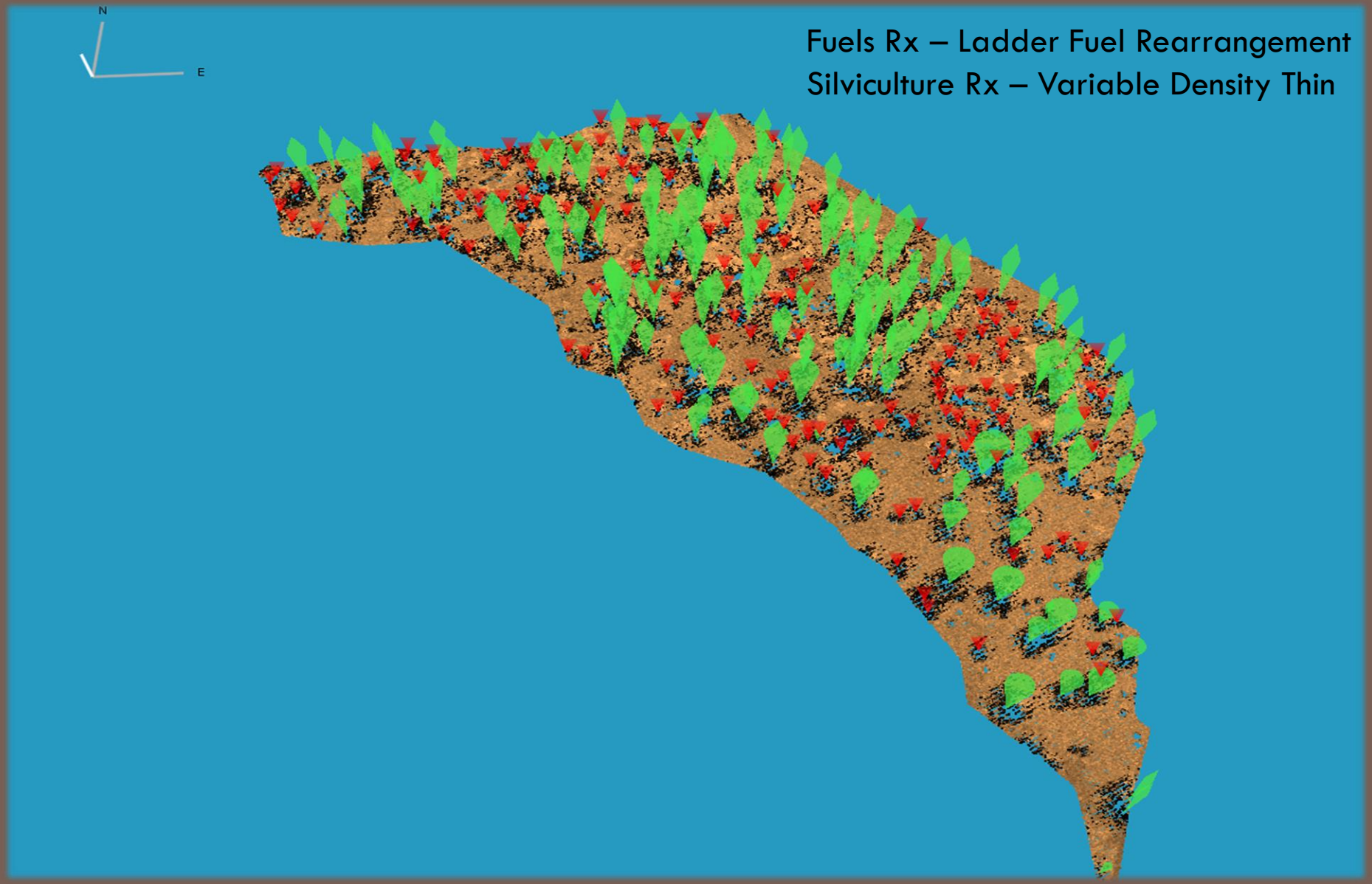
Kirk Evans – USFS Remote Sensing Lab

Carlos Ramirez – USFS Remote Sensing Lab

Fuels Rx – Ladder Fuel Rearrangement



Credits:
Kirk Evans – USFS Remote Sensing Lab
Carlos Ramirez – USFS Remote Sensing Lab



USDA Forest Service
R5 Remote Sensing Lab

Credits:
Kirk Evans – USFS Remote Sensing Lab
Carlos Ramirez – USFS Remote Sensing Lab

USDA Forest Service
R5 Remote Sensing Lab

Credits:

Kirk Evans – USFS Remote Sensing Lab

Carlos Ramirez – USFS Remote Sensing Lab

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R5 Remote Sensing Lab

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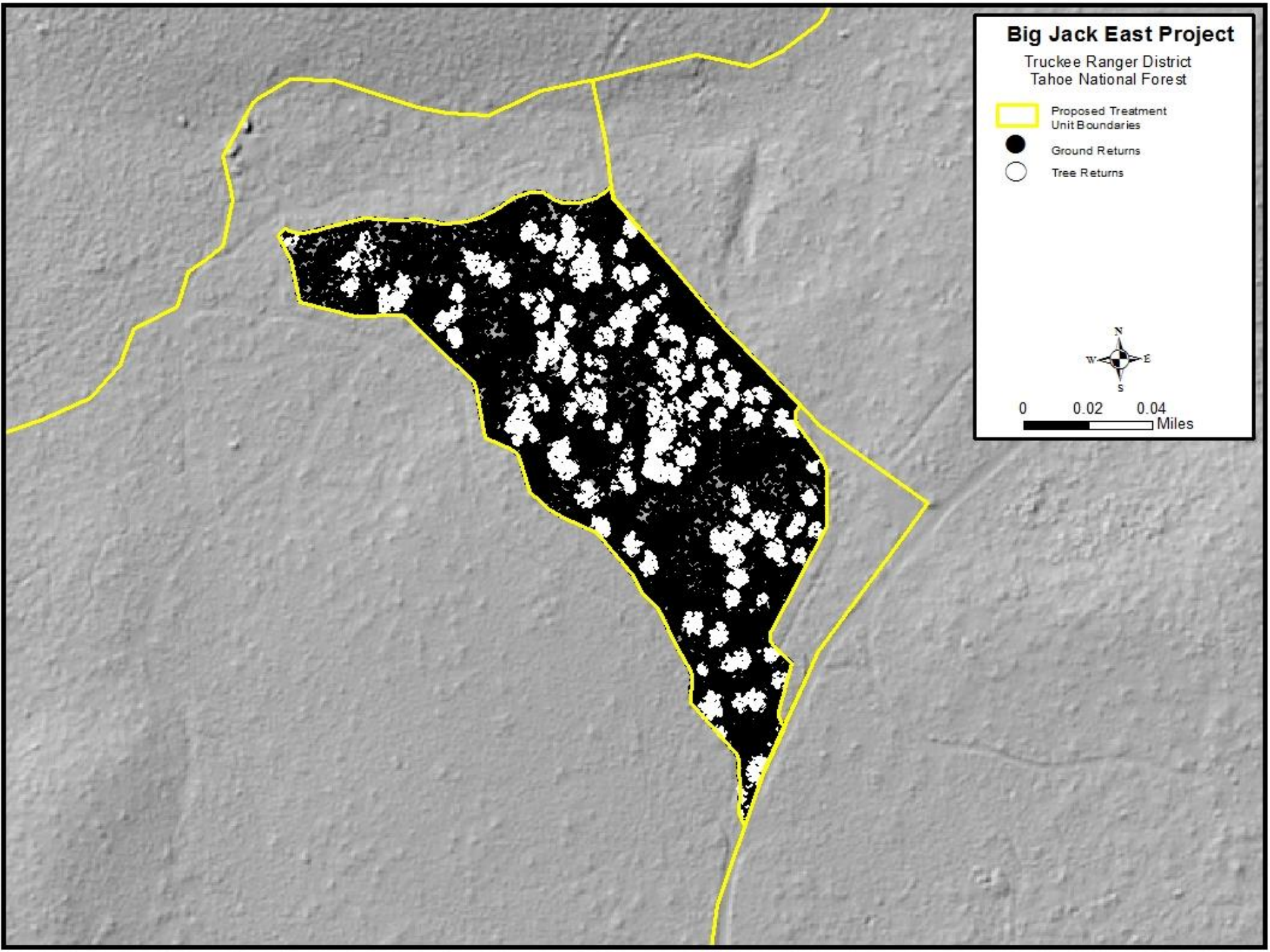
Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Proposed Treatment Unit Boundaries
Ground Returns
Tree Returns
N
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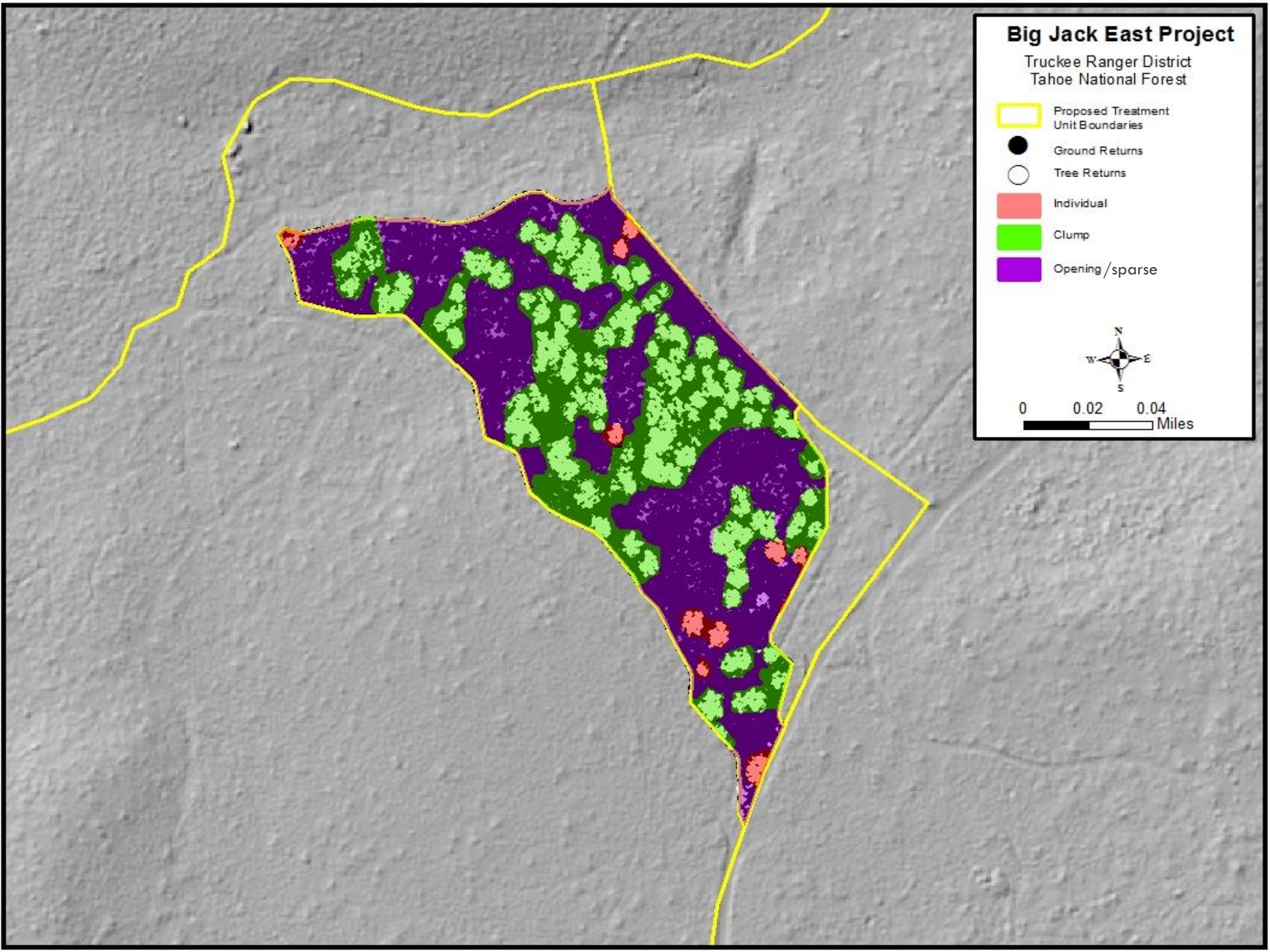
0.02
0.04
Miles


Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Proposed Treatment Unit Boundaries
Ground Returns
Tree Returns
Individual
Clump
Opening/sparse
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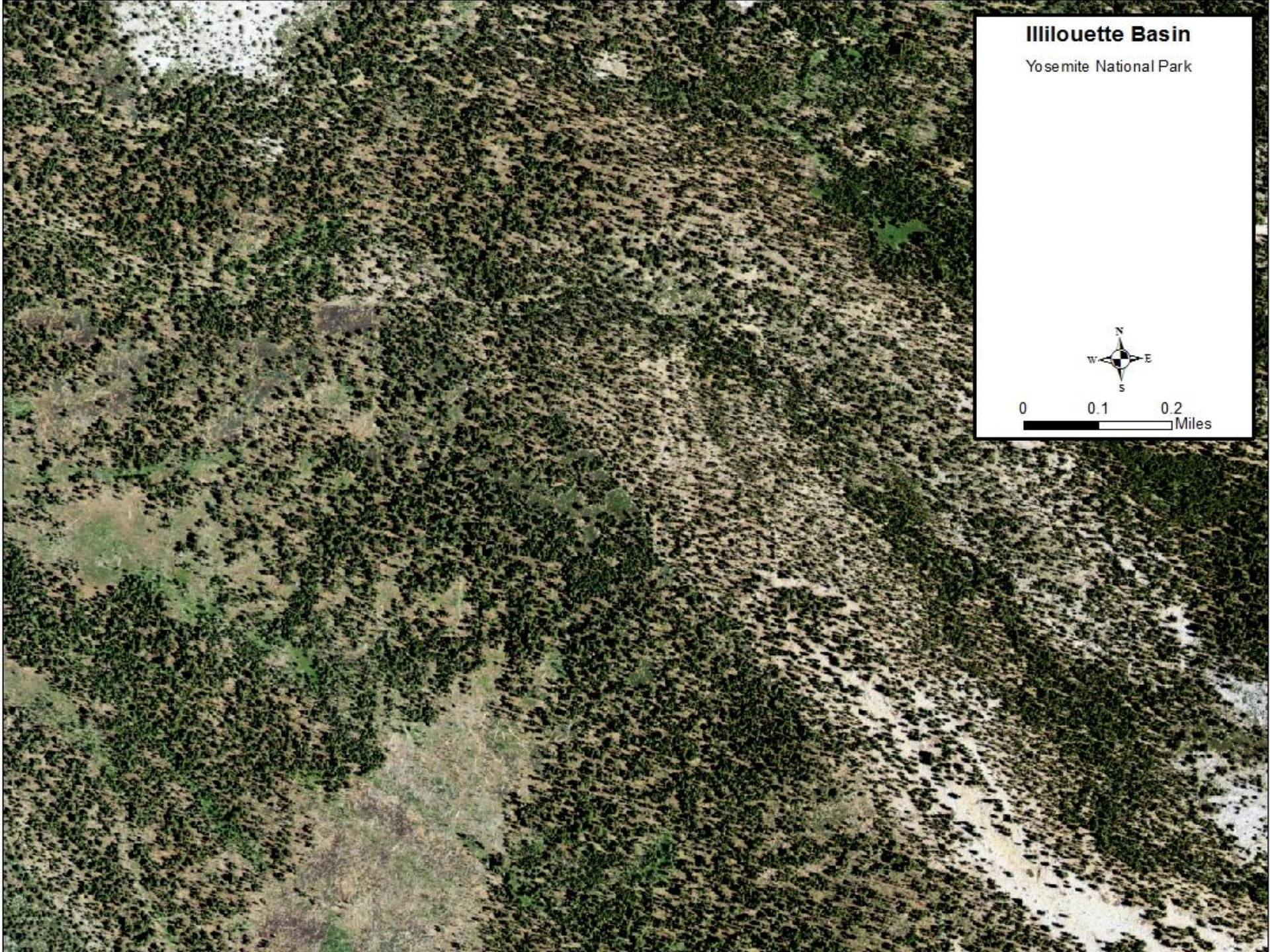
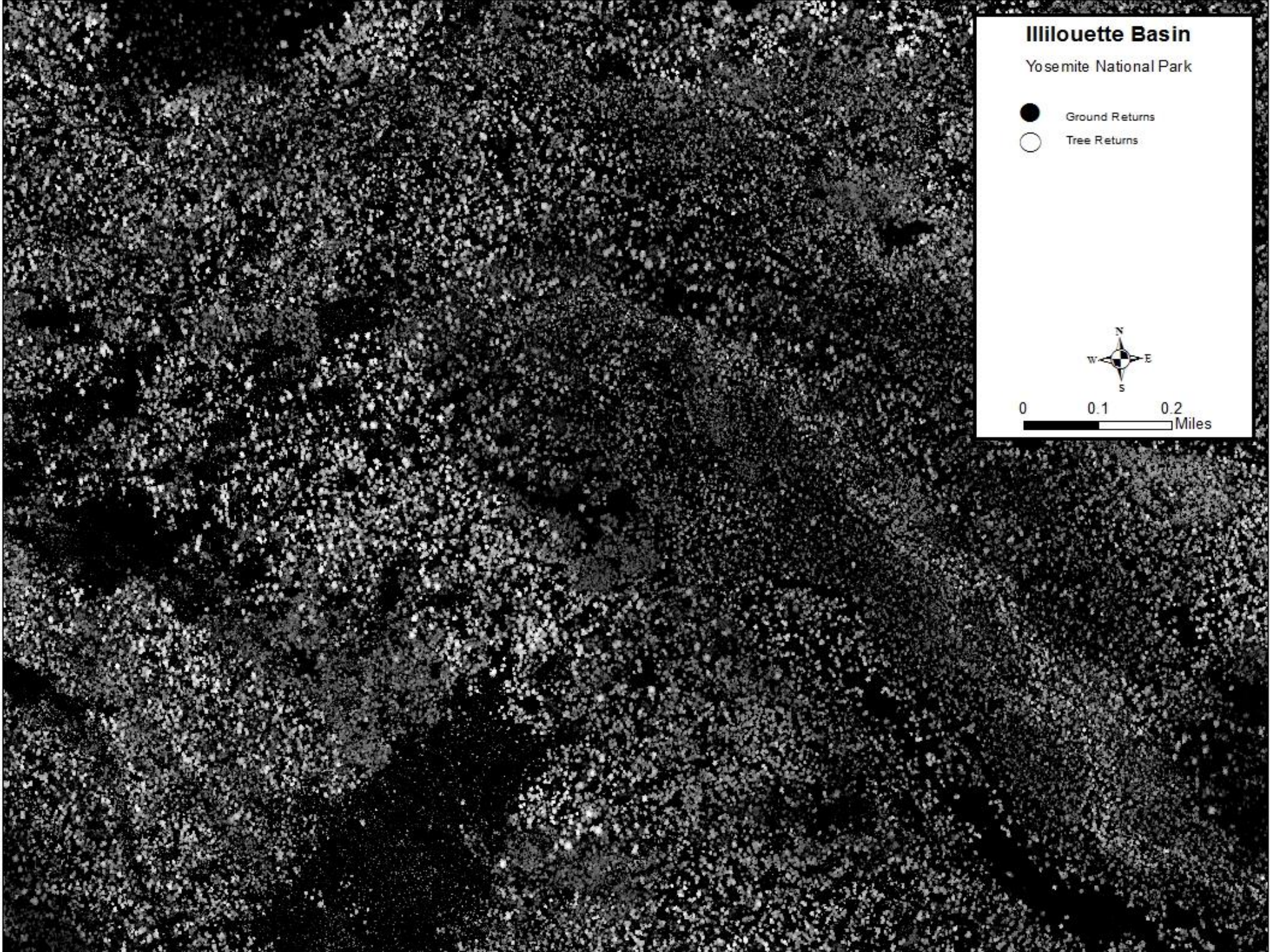
0.02
0.04
Miles


Illilouette Basin
Yosemite National Park
N
W
E
S
0
0.1
0.2
Miles


Illilouette Basin
Yosemite National Park
Ground Returns
Tree Returns
N
W
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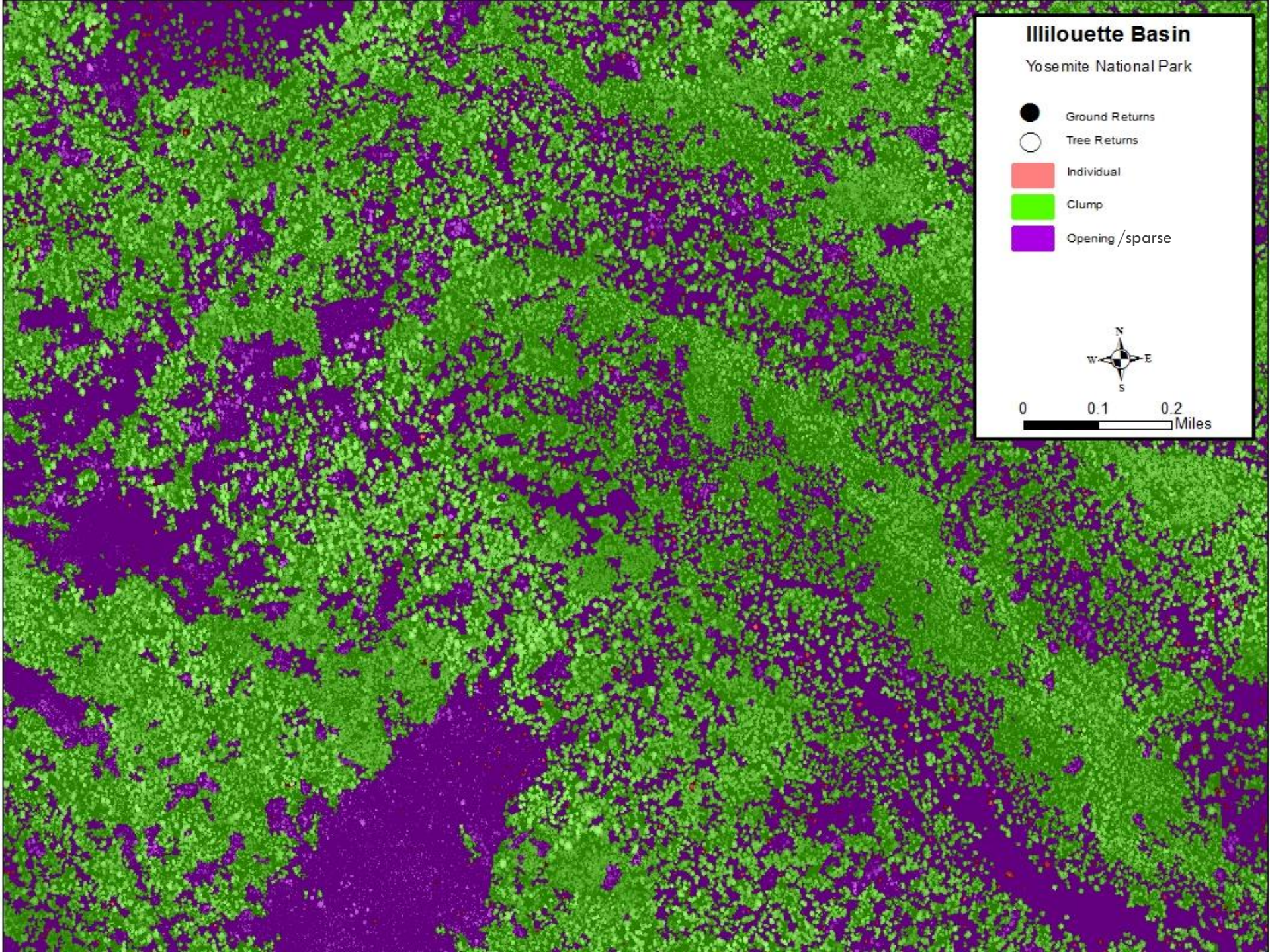
0.1
0.2
Miles


Illilouette Basin
Yosemite National Park
Ground Returns
Tree Returns
Individual
Clump
Opening /sparse
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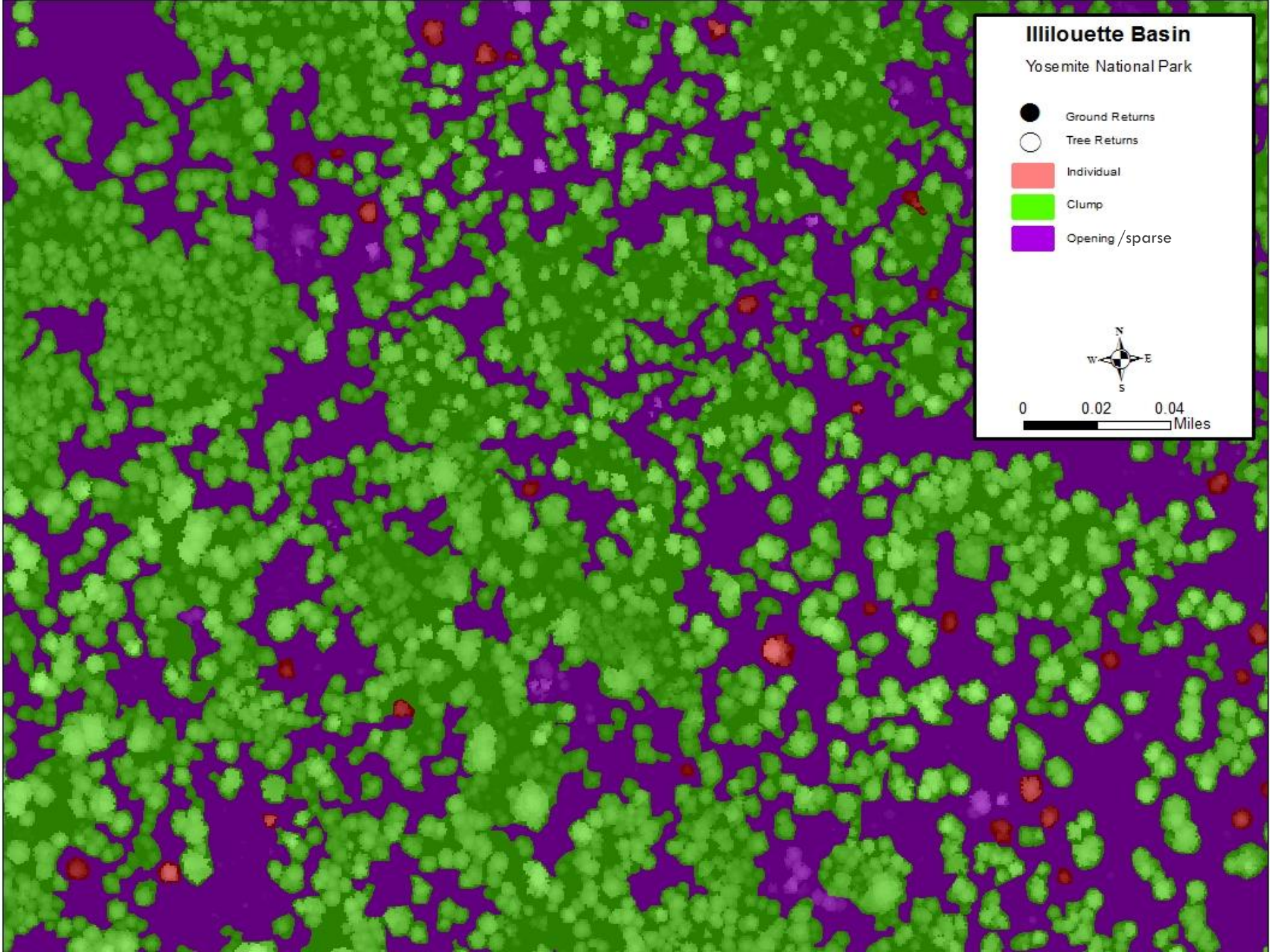
Miles


Illilouette Basin
Yosemite National Park
Ground Returns
Tree Returns
Individual
Clump
Opening /sparse
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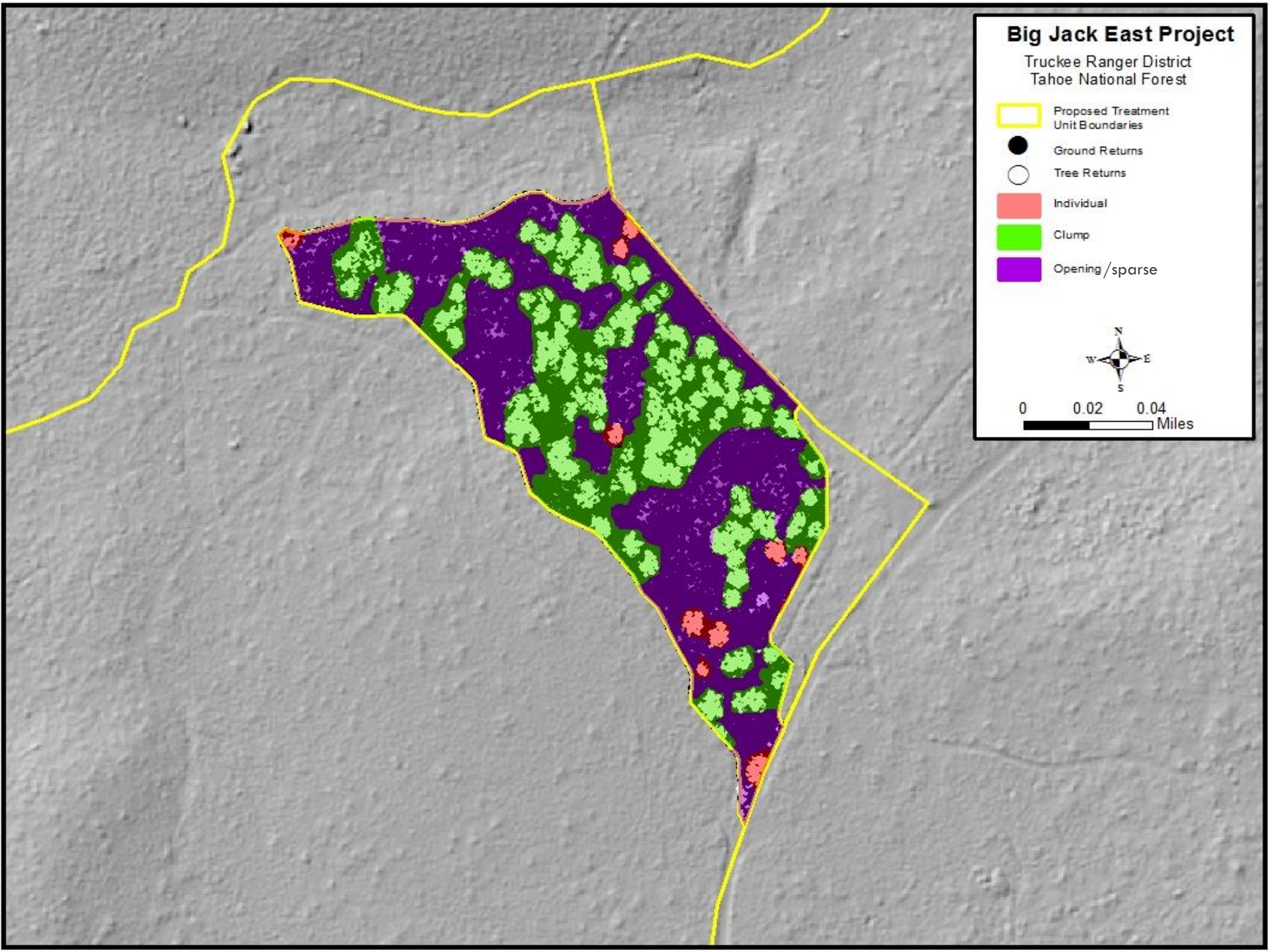
0.02
0.04
Miles


Big Jack East Project
Truckee Ranger District
Tahoe National Forest
Proposed Treatment Unit Boundaries
Ground Returns
Tree Returns
Individual
Clump
Opening/sparse
N
W
E
S
0
0.02
0.04
Miles

Spatial Treatment Effects

- Spatial Variable
  - Inventory
    - Individual = 0.38 TPA
    - Clump = 95%
    - Opening = 1%
  - Reference Condition
    - Individual = 1.87 TPA
    - Clump = 45%
    - Opening = 49%
  - Post treatment
    - Individual = 1.25 TPA
    - Clump = 46%
    - Opening = 50%
  - Alignment
    - Individual = - 0.62 TPA
    - Clump = + 1%
    - Opening = + 1%

Credits:
Van Kane – University of Washington
Derek Churchill – University of Washington

Conclusions

- High Resolution LiDAR and it's derived products has moved from academic to practical
- Comprehensive Individual tree data facilitates reality based treatment effects
  - Couple with visually capable software → inclusion
- EcObject facilitates quantifiable forest structure comparisons at many scales
- EcObject's bundled metrics and scalability can satisfy a project's diverse needs
  - Cradle to grave
  - Single source analysis
- EcObject packaged data improves resource protection
  - Crews can survey what's important and ignore what's not
- Focusing field work saves time → $

  - **Project Scale Saved** (tracked for Big Jack East project)
    - Survey ~ $35k
    - Layout ~ $45k
    - Rx development/designation ~ $25k
    - Stand exams/effects analysis ~ $20k
    - NEPA analysis, appeals, litigation ??

    ➢ **$120,000** (estimated)

- Accurate remote sensing data minimizes the need for verification → saves $/builds trust
- A user friendly data package enables streamlined large scale analysis → saves $/builds trust

  - **Landscape Scale Saved** (for a forest plan revision type of analysis)
    - Data capture ~ $25k
    - Analysis ~ $100k
    - Outputs ~ $15k
    - Appeals, litigation ??

    ➢ **$140,000** (estimated)

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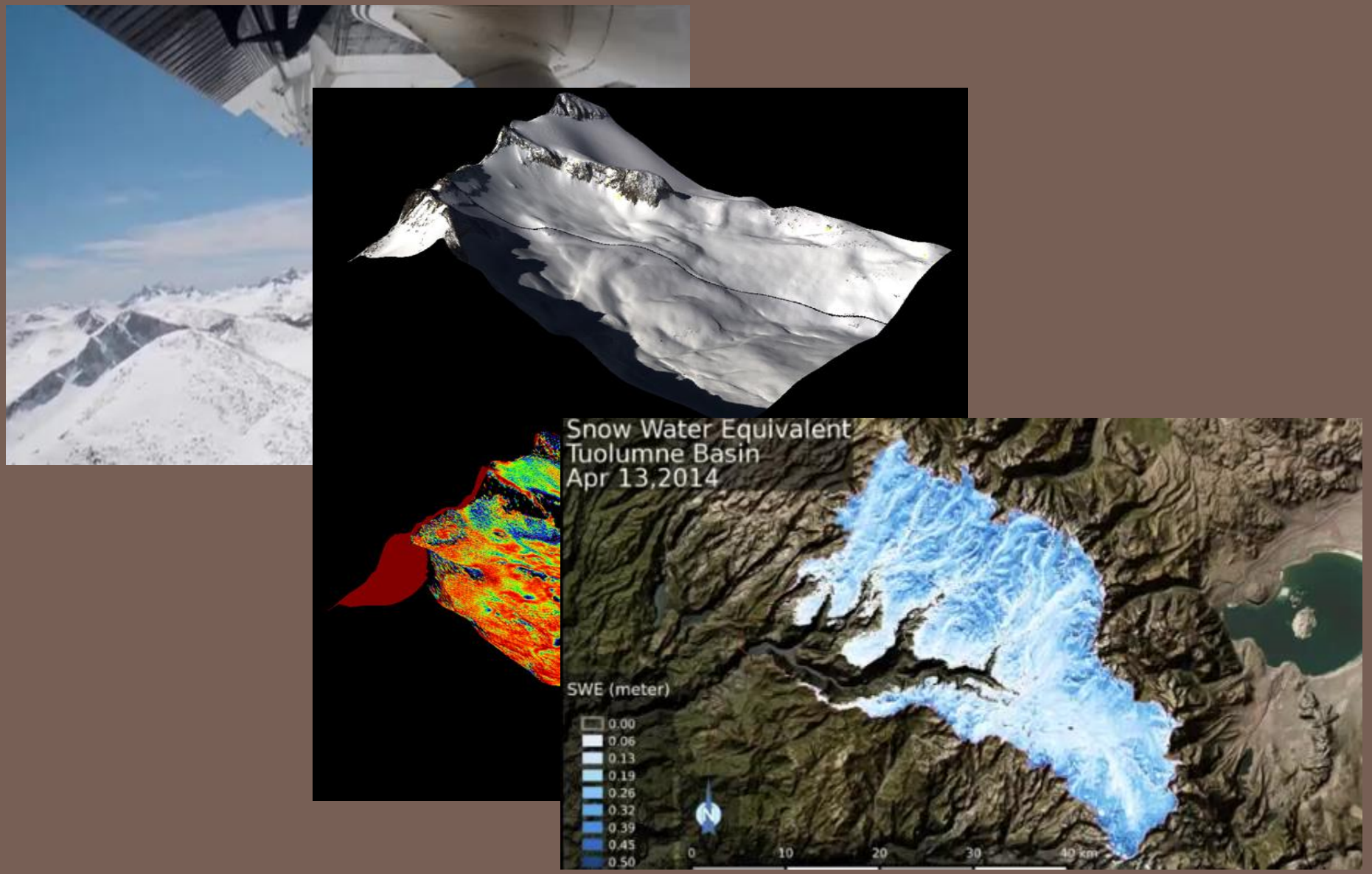
Conclusions

Pace and Scale?

- Improved efficiency → frees up $ for implementation and time for new analyses
- Increased effectiveness → facilitates accurate analysis at the all scales
- The complete picture helps discover other pace and scale barriers
  - risk vs reward

Next Steps

- NASA's Jet Propulsion Lab – Airborne Snow Observatory
  - High resolution with Imaging Spectroscopy (hyperspectral)



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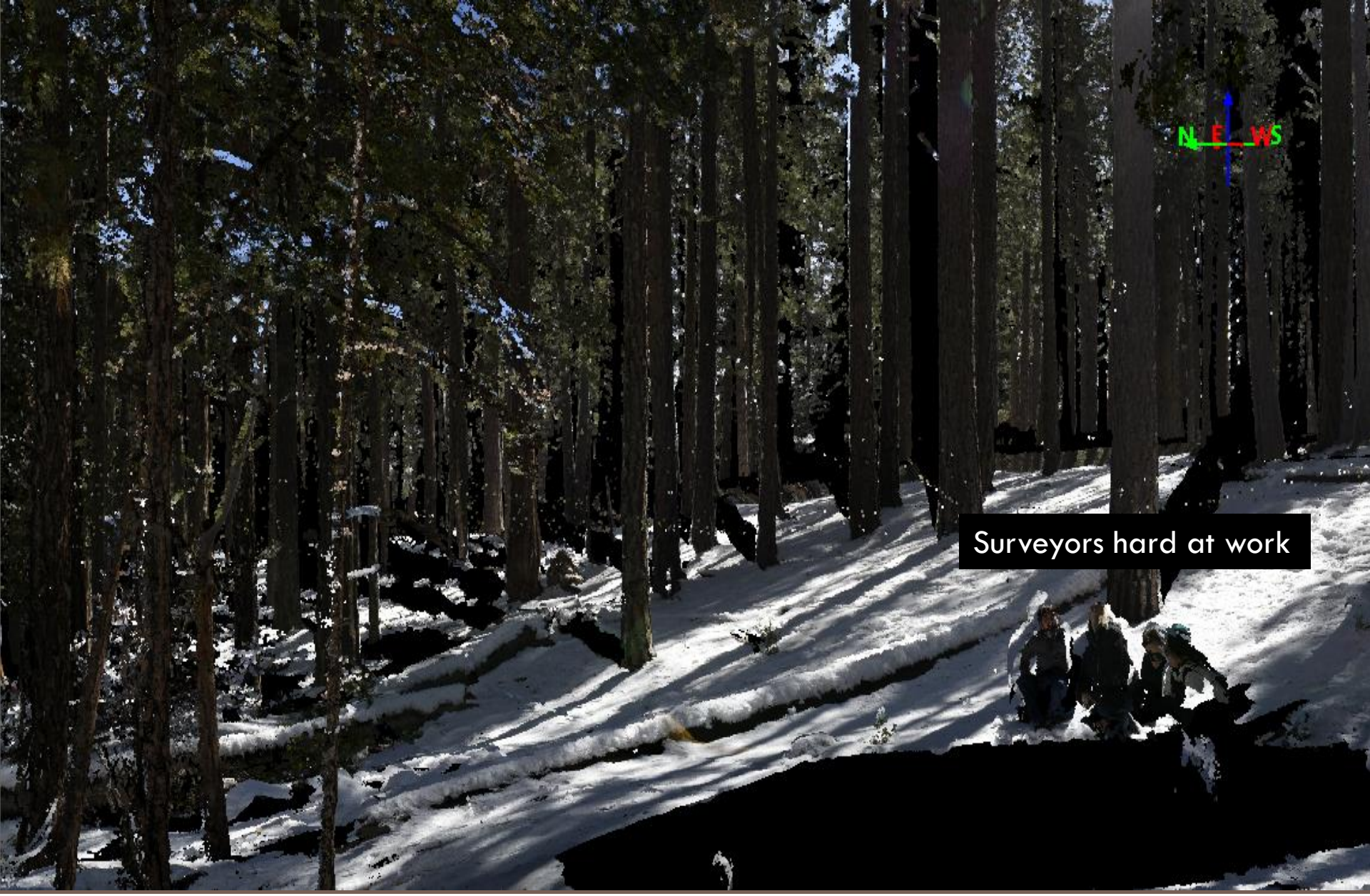
Credits:
NASA's Jet Propulsion Lab/Caltech
Airborne Snow Observatory

Next Steps

- NASA's Jet Propulsion Lab – Airborne Snow Observatory
  - High resolution LiDAR w/ Imaging Spectroscopy (hyperspectral)
  - Interagency Agreement (IA) signatures spring 2017
- Lassen National Forest acquisition summer 2018
- Field campaign summer 2018
- EcObject vegetation map delivery spring/early summer 2019
- Work with University of Washington on resiliency envelope - ongoing
- EcObject Improvements
  - Species identification
  - LiDAR conversion into traditional fuel metrics
  - Field validation campaign with Terrestrial LiDAR Scanning (TLS)



Surveyors hard at work

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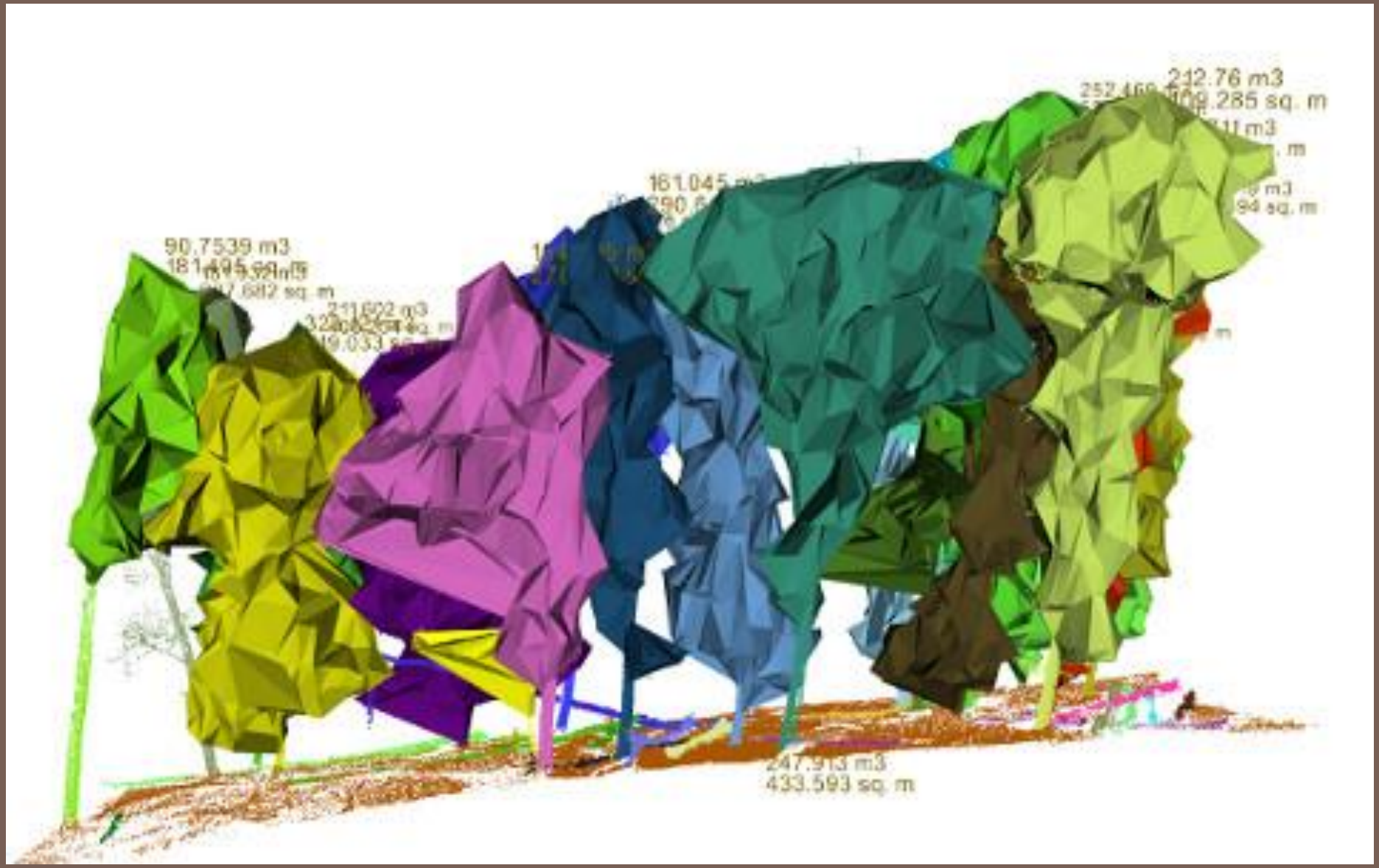
Surveyors hard at work
S
W
N

Credits:
3D FOREST



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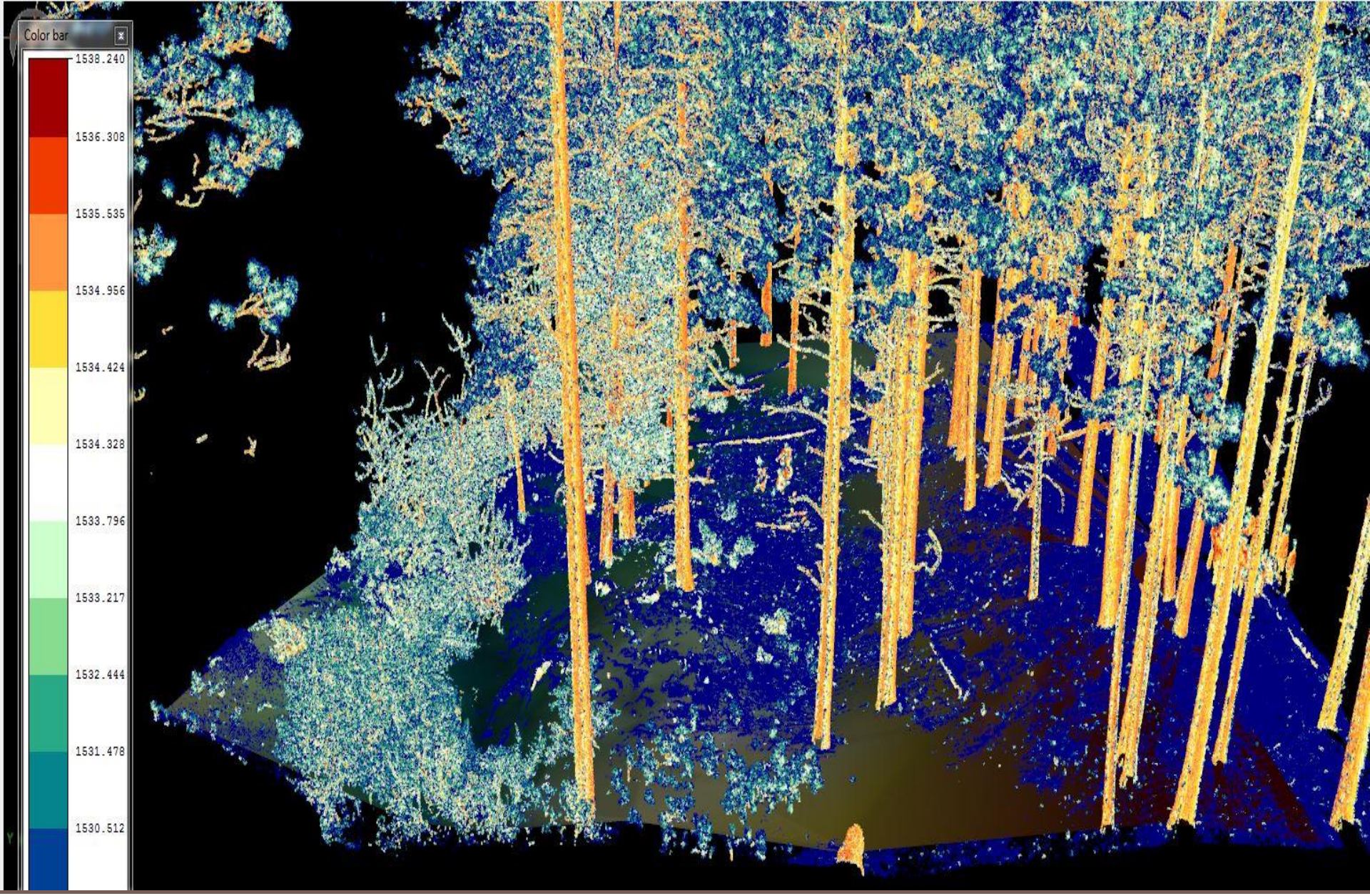
Credits:
3D FOREST



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Credits:
Riegl